PUBLIC WORKS

Oct.
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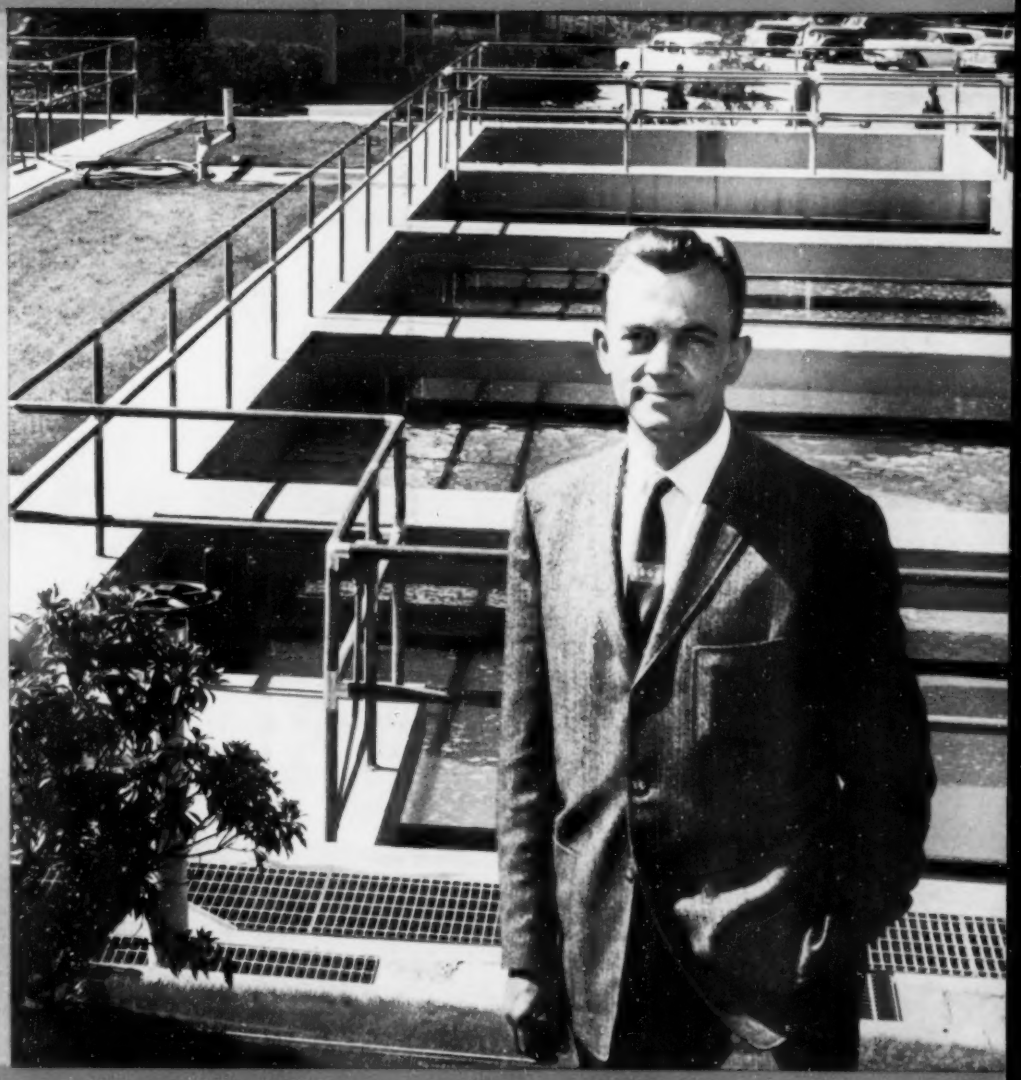

Emil C. Jensen is Chief Sanitary Engineer of the State Board of Health of Washington and former President of FSIWA. More about him on page 18.

All that fuss about a well...

Seems that one day they tested the town well and said it was polluted. Imagine! Our well . . . polluted! Why that well had been serving our town water since Hector was a pup.

So they had a big fuss and then they built a little shed and put a chlorinator in it. Well, they claimed the water was pure, but it tasted *awful*. And the smell around that shed gave the whole town a bad name. Of course, that was only half the time . . . it was being repaired the other half.

Then we gave up. Put in a new kind of chlorinator made by a company I never heard of . . . Fischer & Porter. Talk about spic and span! You could eat off that box. And not only is the smell gone, but believe it or not, the water *tastes* better. They say it's even safer.*

Now you don't have to take *my* word for it. If you're a suspicious kind of person you can get all the proof you want by writing to Fischer & Porter Company, 608 Fischer Road, Hatboro, Pennsylvania.

FP

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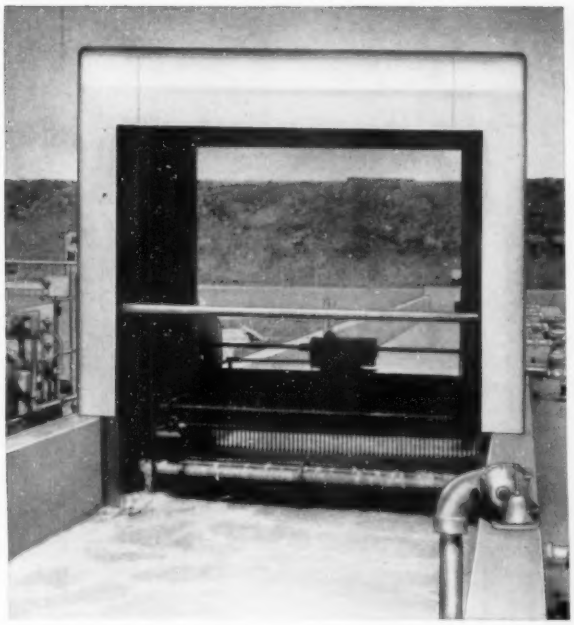
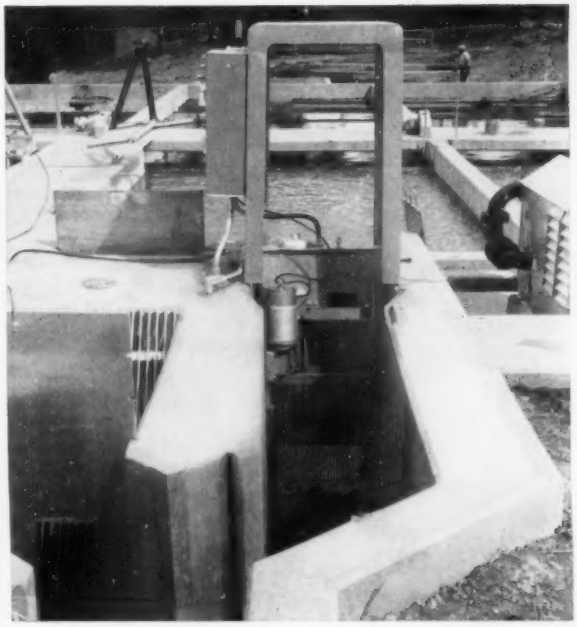
Instrumentation and Chlorination

*Any wonder everyone's *trying* to copy F&P's design now?

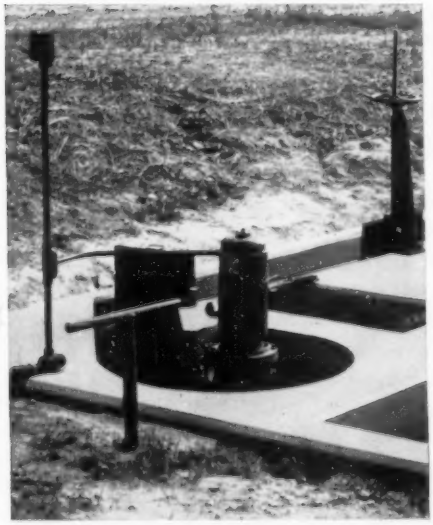


Model "A" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 4 to 12 feet wide . . . sized for flows of 10 MGD and upwards.



Model "B" BARMINUTOR® Screening and Comminuting Machine . . . for use in rectangular channel sections 1 to 3 feet wide . . . sized for flows of .09 to 15 MGD.

"from Chicago" Lower Cost, More Flexible Comminution with BARMINUTOR® Comminuting Machines



"Chicago" COMMINUTOR Screening and Comminuting Machine . . . for use in hydraulically designed feeder basin . . . sized for flows of .175 to 25 MGD per machine.

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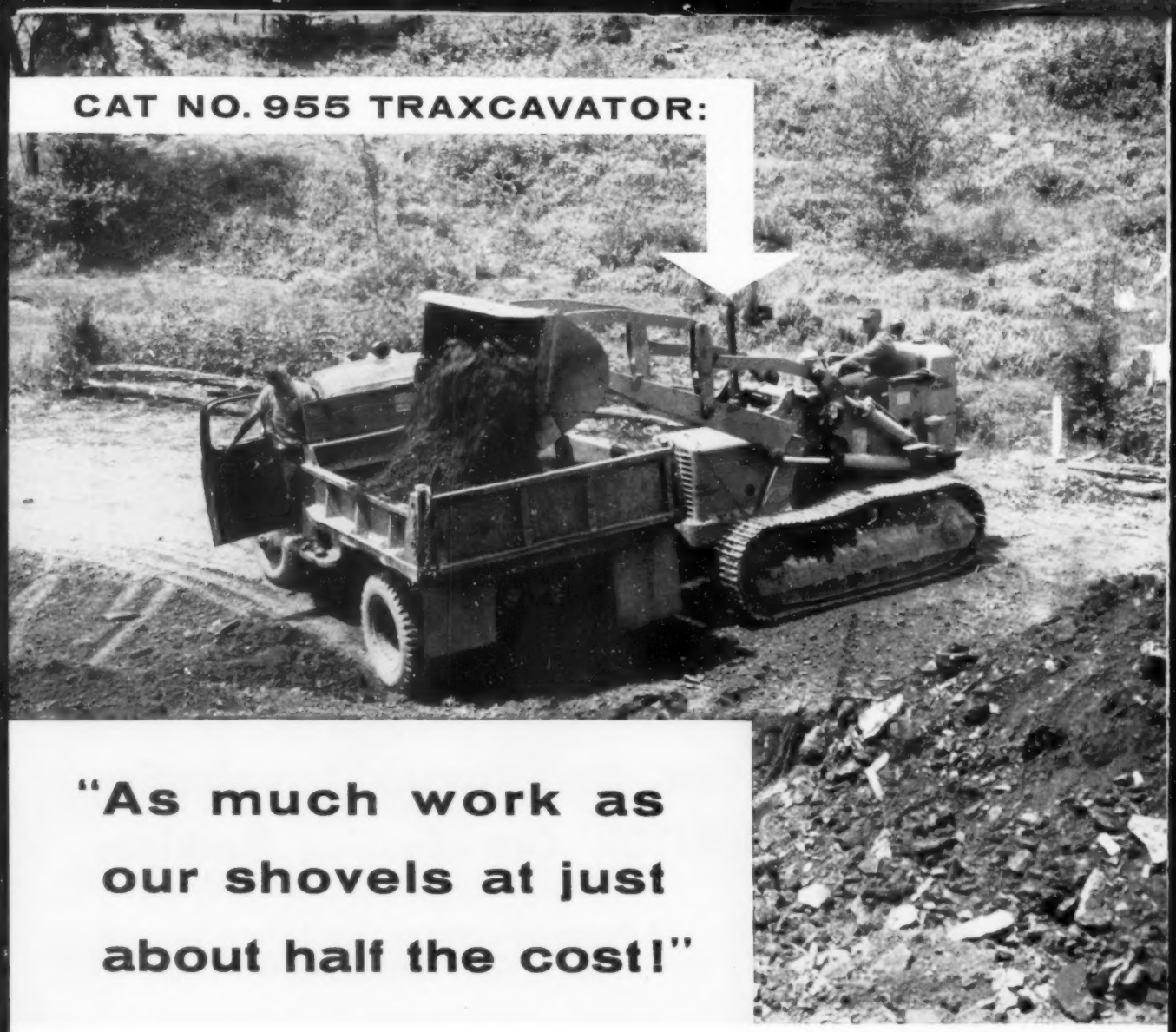
CAT NO. 955 TRAXCAVATOR:



"As much work as our shovels at just about half the cost!"

The Caterpillar No. 955 Traxcavator pictured above is loading dirt on a one-mile road-building job for the Town of Colchester, N. Y. This hard-working machine is part of a 100 per cent Caterpillar team that includes two D6 Tractors and a No. 12 Motor Grader.

"The No. 955 has proven far superior to the shovels we used to use," says Harry M. Shaw, superintendent. "I believe the No. 955 is doing as much work at just about half the cost!"

There are sound reasons why a No. 955 is one of the most versatile machines a municipality can own. Perfect balance of weight, power and capacity keeps the full length of the track always on the ground. A large load at every pass is assured by the 40° bucket tilt-back at ground level.

Now available on the No. 955 is the new Side Dump Bucket, capacity 1⅝ cu. yd. It can dump either forward or to the left, and is interchangeable with the standard bucket—same pins, bolts and nuts used for mounting both buckets.

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Your Caterpillar Dealer has three sizes of Traxcavators in his line. Ask for a demonstration of the one best suited to your municipality. You can count on him for fast service and quality Caterpillar parts.

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BPA

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OCTOBER 1958

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THE MOST USEFUL ENGINEERING MAGAZINE FOR CITIES, COUNTIES AND STATES

How a Four-Man Crew laid 1500 feet a day of CLOW Bell-Tite® pipe through Florida swampland

CLOW cast iron pipe, with the sensational Bell-Tite joint, proved its advantages conclusively in this Clearwater, Florida, installation.

That a four-man crew was able to lay this CLOW Bell-Tite pipe at 1500 feet a day under these adverse conditions is definite evidence of the time, labor and money-saving advantages of this CLOW-designed joint. Two men worked in the trench—often in 3 feet of water. One man lubricating and aligning the joints, the other assembling with a pinch bar. A crane operator and a hook-up man completed the crew.

CLOW Bell-Tite forms a pressure-tight joint—instantly—no bolts or follower glands required. Under practically all conditions, it is the fastest, easiest and most economical pipe for water main installation. Underwriters' Laboratories Inc. listed in diameters 3- through 24-inch.

Shows simple assembly of CLOW Bell-Tite joint. Just wipe clean, lubricate and push spigot into the bell. When painted yellow stripe is no longer visible, joint is bottle tight.

Under-water assembly of 8" Bell-Tite pipe at Clearwater, Fla.
Contractor: Hancock Pipe Company, Clearwater, Fla.

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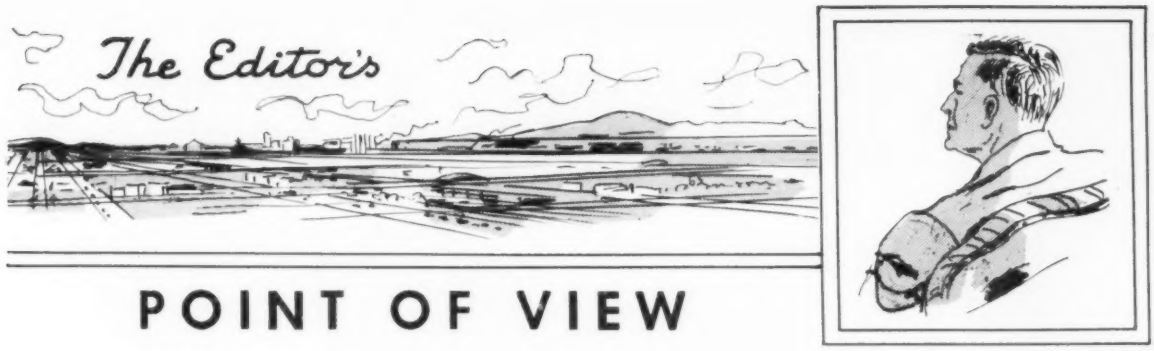


POINT OF VIEW

Our New Highways and Housing Relationships to Central City Areas

SINCE THE LATEST decennial census, much of our national population increase has been registered in the 172 standard metropolitan areas; but the principal gains are in the fringes of and outside the cities. This trend will probably continue; and, since most city limits are fixed, for all practical purposes, a majority of the new houses in the immediate future will probably be built in the suburbs of these parent cities, but at an ever-increasing distance from them.

However, a new and important factor now enters the picture —the national highway system. There is no doubt that this factor will create a new trend of decentralization still farther from the parent cities. Time, not distance, is the major consideration for travel to work. So, with the new expressways will come a further spreading out, accentuated by the location of industries, shopping centers, restaurants, motels and other service installations along these highways. All of these will be independent of the original city and each will be the nucleus of a potential new residential and business community.

The old concept of our cities is passing. They are still highly important factors in our national life, but a new phase is fast approaching which will create problems that will need new answers for their solution. It is probably too much to say now that many cities will remain static while other governmental forms will assume the new responsibilities; but the long range trend may well be that way.

Water Allocations and Water Rights

WITH THE GROWING demands for water, the matter of who owns or can use water, and how much, is a problem that will get larger and larger. In general, our water quantity will not increase unless low-cost methods of desalting sea water are developed. In many areas, water quantity is now critical, and it will become more so as needs for water continue to grow.

The old theory that the riparian owner can use the stream without substantial impairment in quantity or quality does not fully meet modern day needs. There are many angles that the courts must decide on and none of these is simple. Moreover, the body of past decisions has largely been based on local conditions and does not represent any basically sound approach to the broad problem of water use and allocation. No doubt, as the importance of water rights grow, the courts will develop such a policy. In the meantime, engineers have a responsibility in this matter of water resources and it is sincerely to be hoped that they will, without hesitation, face up to this responsibility. If they will determine to do so, they can be important and highly valuable in guiding soundly the future of water use. Technically they are best equipped to take this responsibility; if they stand aside others will surely step forward whether or not capable of handling the job. There is work to be done; the question is who will do it.

The High Cost of Traffic Accidents

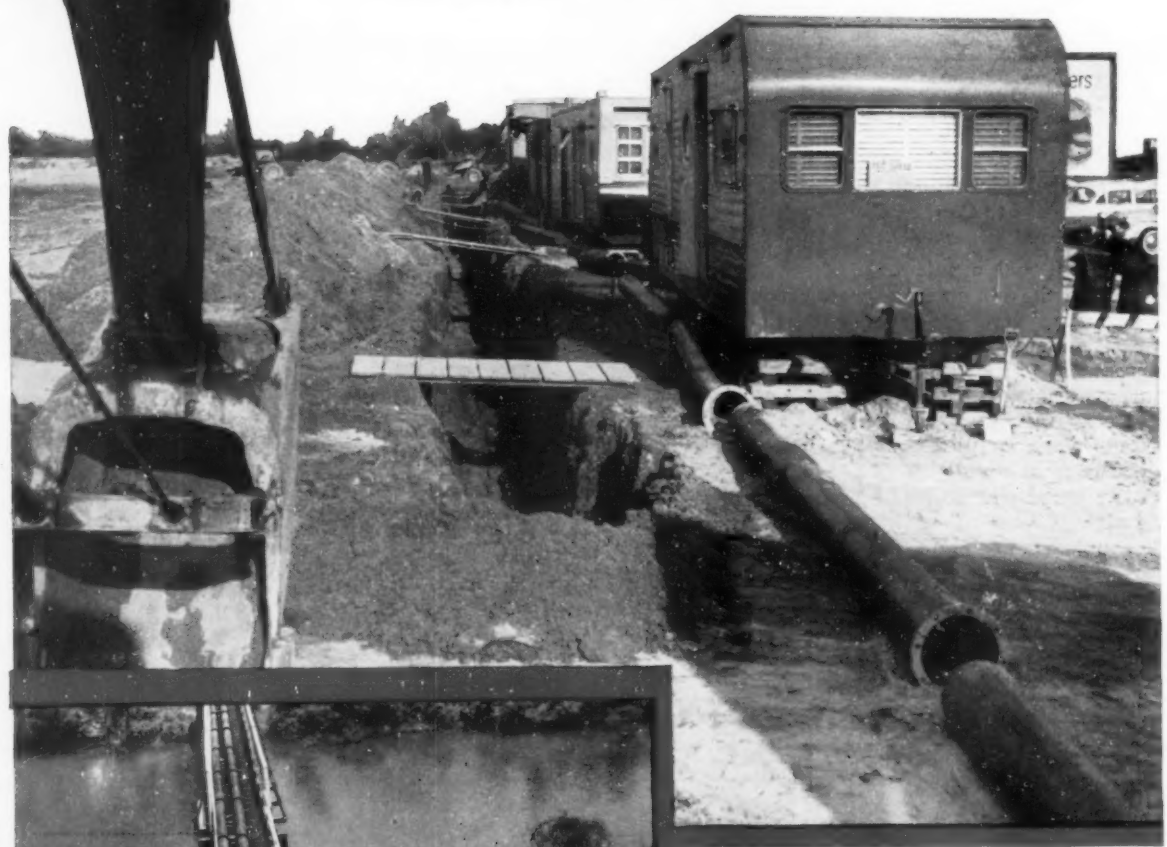
NAVY AND MARINE Corps personnel, during 1957, spent 311,423 days in hospitals as a result of motor vehicle injuries; in addition 570 servicemen were killed. These figures point up the very high toll that fast or careless driving, inadequate highways and allied factors levy on motorists.

Of the accidents, 31 percent (with 33 percent of the deaths) involved running off the road; 28 percent (with another 33 percent of the deaths) resulted from collisions with other motor vehicles. The average of 45 days in a hospital emphasizes how severe such accidents are and the necessity for doing everything possible to reduce traffic accident rates.

The Problems of Backyard Swimming Pools

A CURRENT TREND toward widespread installation of backyard swimming pools is posing problems for health authorities. Regulations have been adopted by a few communities in respect to construction and use. These will not eliminate all of the problems, a few of which are water treatment; inspection and testing; control of use; and mosquito production. In many communities, regulations exist governing mosquito breeding areas, and in most places the right to pass such regulations is unquestioned. In respect to the other phases of the problem, the situation is less clear. For instance, how many neighbors may use the pool and what standards of water quality can be applied—and enforced? What control is possible over the water discharged from the pool? And what about water use demands on a system already nearing its ultimate capacity? All these are factors that those in charge of health and water departments ought to consider.

DOLLAR



Ash disposal line for power plant in Alabama, being constructed with 12" Mechanical Joint Cast Iron Pipe.

Big Business, too, chooses Cast Iron Pipe

Fire protection line for large automotive plant in New Jersey, built with Mechanical Joint Cast Iron Pipe.

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6 reasons why Cast Iron Pipe is #1 choice of U. S. A.

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   Cement lined cast iron pipe and fittings will not tuberculate . . . delivers a full flow for the life of the pipe.
2. LONG LIFE . . .
   42 North American cities are still using cast iron water mains laid 100 years and more ago. Hundreds more have passed the 50 year mark.
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5. CORROSION RESISTANCE . . .
   Cast Iron Pipe effectively resists corrosion . . . vital factor in its long life and dependability.
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—PERFORM A DOZEN DIFFERENT JOBS

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OTHER MASSEY-FERGUSON INDUSTRIAL EQUIPMENT includes the Work Bull 1001 Multi-Purpose Tractor Loader (60.3 h. p.), Work Bull 202 (40 h. p.) with integrated Davis Loader-Backhoe, and the Work Bull Fork Lift with 10 easy-to-change attachments.

For information on the complete Massey-Ferguson line ask for Brochure G-4. For specific information on the Work Bull 303 ask for Brochure W-3. *Write Massey-Ferguson Industrial Division, 1009 South West Street, Wichita 13N, Kansas.*

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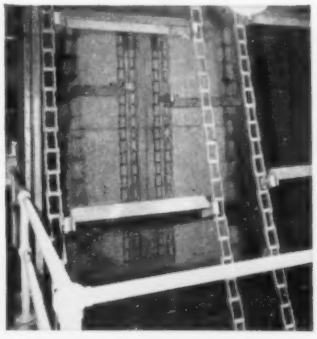
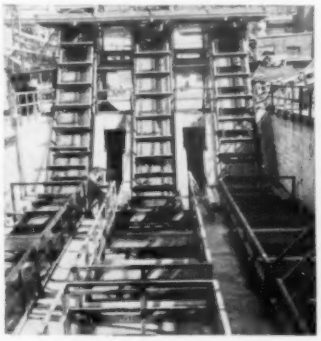
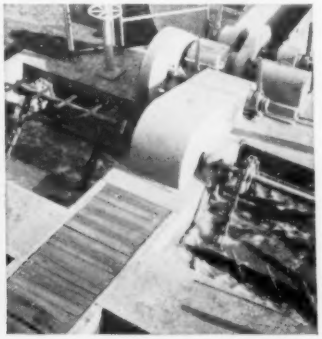
TYPE S — This chain and pitched flight Straightline grit collector is designed for shallow channels . . . discharges grit to washing and dewatering screw at influent end of chamber.



TYPE B Straightline grit collector is ideal for deep channels. It consists of either a single or double strand collector with buckets that elevate grit to washing and dewatering screw.



TYPES IH AND IM Straightline grit collectors economically remove inorganic solids or sewage grit where no washing is desired. Flights dewater material as it is elevated to discharge point.



TYPES AB, AS, AND ASB Straightline aerated grit collectors use compressed air to create and maintain velocities which produce optimum conditions for separating solids at all flows.

Gary, Indiana PROJECT

Selects PRESS-SEAL Rubber Gaskets

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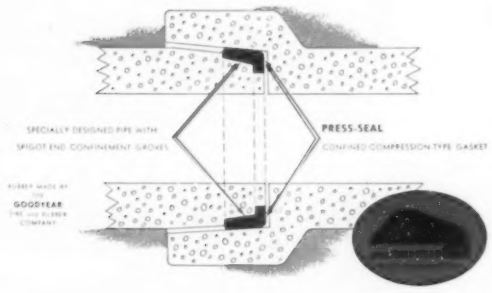
RESIDENT ENGINEER: Vic Weidman, Gary, Indiana
CITY ENGINEER: Harold Zweig, President of Sanitary Board, Gary, Indiana

GENERAL CONTRACTOR: Witter Corporation, Schererville, Indiana. Reinforced concrete pipe designed to use Press-Seal Rubber Gaskets, 108-inch and down, furnished by American Marietta Company.



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County road duty tests operator and machine

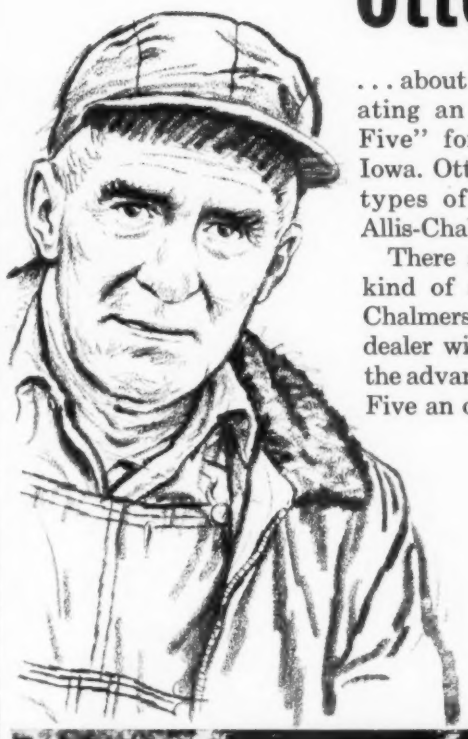
Otto Nikoley, Alta, Iowa, works full time maintaining roads for Buena Vista County.

Eight months a year, he and the Allis-Chalmers Forty Five motor grader work a program of finishing dirt and gravel roads. An average of three passes is all that's required to finish most of his jobs. During winter months, the grader is still productive. Equipped with snowplow, the machine is busy keeping roads open and traffic on the move.

Otto and the Forty Five work well together. There's plenty of power at hand to do the job. The Forty Five is easy operating, too. The platform is roomy and the deck is clear. Visibility is excellent all around, sitting or standing. And the blade's controls can't kick back. When Otto moves the lever, toggle engages or releases clutches surely, without wrist-snapping backlash.

Put your operators on Allis-Chalmers motor graders. More and more counties are stretching tax dollars by doing it. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wis.

Ask Operator Otto Nikoley



. . . about motor graders. He's operating an Allis-Chalmers "Forty Five" for Buena Vista County, Iowa. Otto will tell you that of all types of graders, his choice is Allis-Chalmers every time.

There are good reasons for this kind of enthusiasm. Your Allis-Chalmers construction machinery dealer will be glad to demonstrate the advantages that make the Forty Five an operator's favorite.

FORTY FIVE

120 hp • 6 speeds forward • 3 speeds reverse • 23,800 lb

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elevated water tank

This functional and completely modern tank is CB&I's practical method of providing economical gravity pressure water supply for small municipalities and private water systems.

Designed and built in accordance with AWWA or standard fire underwriters specifications, the Horton Tripod is furnished to the exacting standards which have made CB&I elevated water storage structures the *municipal preference* for decades. The all-welded structure is smooth and streamlined. It is easy and economical to paint and maintain and does not require elaborate foundations.

Write your nearest CB&I office for details on Horton Tripod tanks.

CB&I

Chicago Bridge & Iron Company

Atlanta • Birmingham • Boston • Chicago • Cleveland • Detroit • Houston • Kansas City (Mo.)
New Orleans • New York • Philadelphia • Pittsburgh • Salt Lake City
San Francisco • Seattle • South Pasadena • Tulsa
Plants in BIRMINGHAM, CHICAGO, SALT LAKE CITY,
GREENVILLE, PA. and at NEW CASTLE, DELAWARE.
In Canada: HORTON STEEL WORKS LTD., TORONTO, ONTARIO

STANDARD SIZES

Horton *Tripod tanks* are built in capacities from 15,000 to 75,000 gallons. Standard heights to bottom range from 25 to 125 feet.

M52C

Here's what happened when the Fox High Efficiency Spreader took over the sanding job

"Saved $4000 in material cost in a single season..."

—says Russell J. Clark, Orange County, New York
"Sleet and ice conditions were the worst in our history last year. Due to the efficiency of the Auger Feed in our new Fox Sander we effectively used bank-run material for sanding, instead of washed sand, that had previously been used. This saved the Town of Cornwall over $4000 in material cost over the previous year."

Demonstrated adaptability for Town of Erving, Massachusetts—because ". . . the Fox Spreader gives complete coverage on any width of road . . . is easy to fill with front end loader . . . can be used to cover tar and asphalt, too."

Saves manpower in Omaha, Nebraska—because ". . . the Fox Spreader is a one-man operated machine . . . can be mounted and dismounted on our trucks in a few minutes . . . can be operated at traffic speeds and does not interfere with, or hold up traffic."

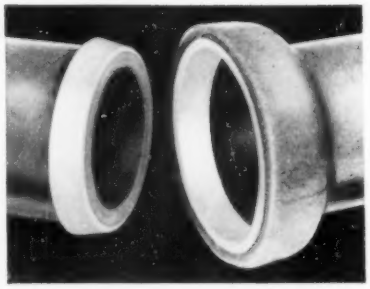
Fox Mountable Sand Spreaders can be installed on *your* dump trucks in a matter of minutes. One man—the driver—controls entire operation from cab. High efficiency auger feed and spinner cover nearly half again as much area, with a given amount of material, as most spreaders. Spread adjustable—from 8 to 40 feet. Makes your maintenance budget go farther.

Ask your nearest dealer to demonstrate. Or, if you don't know a Fox dealer, write, wire or phone us collect for specifications, details and other user experiences.

FOX RIVER TRACTOR CO.
Dept. R3, 1020 NORTH RANKIN ST.
APPLETON, WISCONSIN • Phone REgent 4-1451

over 100,000 miles of AMVIT Jointed Clay Pipe installed in FOUR YEARS

Only Factory-Made Mechanical Joint
With an Outstanding Service Record
In Hundreds of Vital Sewer Systems



Never before in the history of the sanitary sewer construction industry has a product gained such immediate and wide acceptance and usage in such a short period of time.

In the past few years, over 100,000 miles of Amvit* have been installed across the country with outstanding results.

Experience has shown Amvit is the engineer's choice. Here's why:—

1 QUICK INSTALLATION SAVES LABOR

Amvit Jointed Clay Pipe is delivered to the job site ready for use. Just push the pipe together and the joint is made — sure and tight. No more fussing with caulking, hot pots, joint compound.

2 FACTORY-MADE QUALITY

The Amvit Joint is manufactured from plasticized resins of polyvinyl chloride. No other combination of materials is used or needed. It is applied on the pipe at the factory and delivered ready for immediate installation.

3 ROOTPROOF

The design of the Amvit Joint is based on the ball and socket principle. The material on the spigot end is convex shape, with the bell in a concave shape. This permits easy and rapid installation. When the joint is made, it reaches maximum compression which results in a really tight line. Nothing can enter the line.

4 PREVENTS INFILTRATION

Due to the tightness of the joint, ground water cannot enter the line. Since infiltration is eliminated, the sanitary sewer does not have to carry anything other than that for which it was designed. This permits the use of smaller sized pipe in many instances and will reduce material cost.

5 BETTER FLOW, LESS MAINTENANCE

The design of the Amvit Joint assures self-centering which gives a smoother invert and better flow characteristics. Because the joint is really tight, no foreign matter such as dirt, sand, and stones can possibly enter the line.

6 COMPLETE FITTINGS

Amvit is furnished on all standard fittings, as well as pipe from 4" thru 24" diameters. It is now available for immediate delivery in Northeast and Central States.

For a new descriptive folder on how Amvit can help you cut sewer project costs, write American Vitrified Products Company, National City Bank Building, Cleveland, Ohio, or our office nearest you.

SINCE 1848

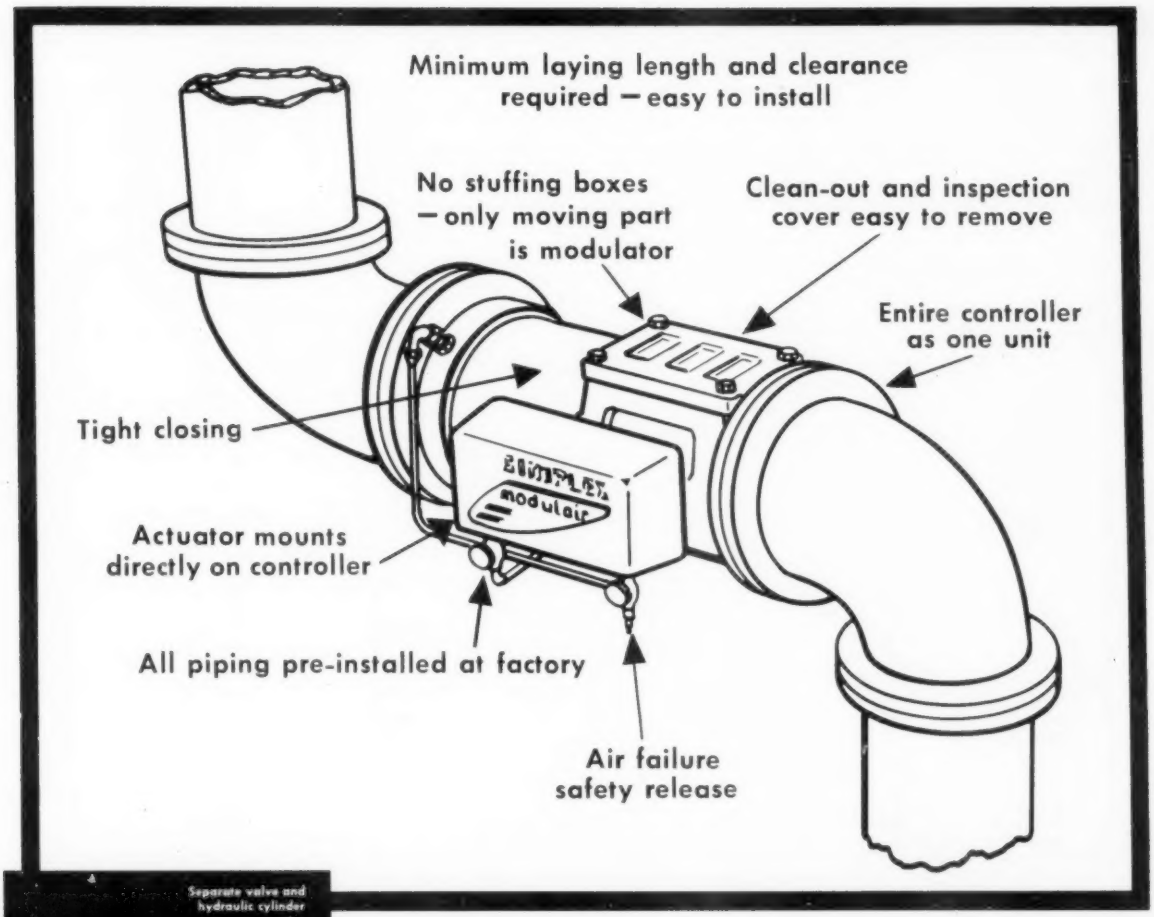
AMERICAN

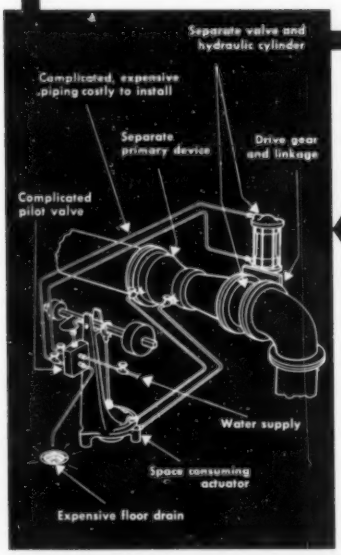
American Vitrified Products Company

CLEVELAND, OHIO

*T. M. Registered

Plants Across the Nation... Brazil, Indiana • Chicago, Illinois • Cleveland, Ohio • Crawfordsville, Indiana • Detroit, Michigan • East Liverpool, Ohio Fenton, Michigan • Grand Ledge, Michigan • Lisbon, Ohio • Los Angeles, California • Milwaukee, Wisconsin • South Bend, Indiana • St. Louis, Missouri • White Hall, Illinois


Minimum laying length and clearance required — easy to install
No stuffing boxes — only moving part is modulator
Clean-out and inspection cover easy to remove
Entire controller as one unit
Tight closing
Actuator mounts directly on controller
All piping pre-installed at factory
Air failure safety release
SIMPLEX
modulair



COMPARE and see how new Modulair® Flow Controller makes this design obsolete

best of all . . .

Simplex Modulair saves you money three ways

During 6 years of extensive use, the Modulair Rate of Flow Controller has proved time and time again that it can save money three ways:

1. Its unit construction makes it your best buy on a first cost basis.
2. You save installation time and money. Modulair is as easy to install as a piece of pipe.
3. Maintenance is practically nil, because of Modulair's exceptionally simple design.

If all this interests you, write for our Bulletin 951.

SIMPLEX®

VALVE AND METER COMPANY

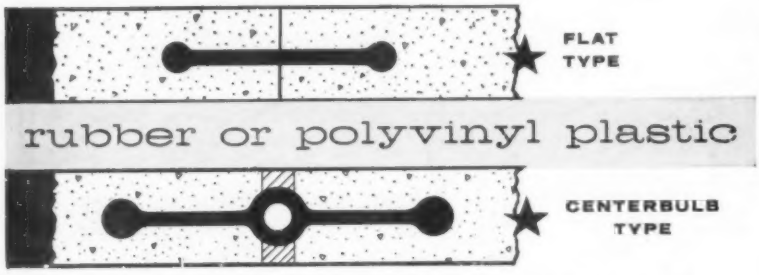
LANCASTER, PENNSYLVANIA

SERVICISED

DUMBBELL DESIGN

WATERSTOP

for Watertight Concrete Joints



Servicised Dumbbell design has been used for more than 25 years in heavy concrete structures and where hydrostatic water pressure is present because it provides better retention of the waterstop in the joint during horizontal or vertical movement. When concrete contracts and the joint opens up, outer dumbbell edges become more tightly engaged with the concrete, making a tighter seal as the tension increases due to movement either in the joint or increasing water pressure on one side of the joint. Dumbbell design waterstop is made from rubber or polyvinyl plastic in both flat or centerbulb types. Write for special Catalog.

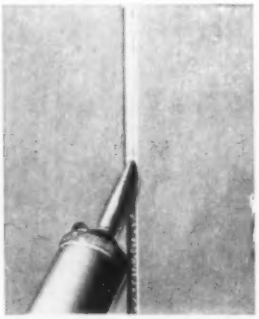
VERTISEAL

cold applied vertical joint sealer

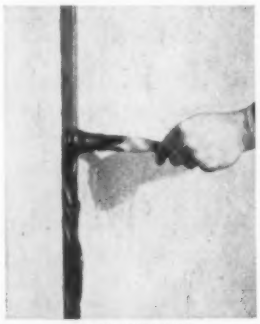
★ Self-vulcanizing
★ No cold flow after cure
★ Maintains bond from below 0° to 150° F.
★ Black . . . White . . . Gray colors

Vertiseal is an extremely efficient joint sealing compound . . . resistant to petroleum derivatives, most common acids, fats and alkalis. Stable Composition, superior cohesive and adhesive qualities, and simple installation with caulking gun or by troweling, make Vertiseal first choice for sealing virtually any type of vertical or horizontal joints.

Write for special Vertiseal Catalog and Specifications.



APPLIED WITH CAULKING GUN



BY TROWELING

SERVICISED PRODUCTS CORPORATION
8051 WEST 65th STREET · CHICAGO 38, ILLINOIS

Emil C. Jensen is Chief of the Engineering and Sanitation Division of the Washington State Department of Health. He has held this position for the past 13 years and has been with the Department for 17 years. Following graduation with a BS in CE degree from the University of Washington, he worked in stress analysis for Boeing before going to Harvard for an MS in sanitary engineering. In his present position he is responsible for water supply, waste treatment, stream and air pollution, radiation hazards, swimming pools and insect and rodent vectors, plus a few other jobs. He is shown on the cover at the sewage treatment plant of the Southwest Suburban Sewer District in metropolitan Seattle, a modern plant designed by Hill and Ingman and operated by Ralph Bucklin.

He has been active in sanitary engineering within and outside of his state. He is a recent president of the Federation of Sewage and Industrial Wastes Associations; a consultant to the Public Health Service and a PHS reserve officer; and is on advisory committees for the AEC at Hanford for waste disposal and for the Sanitary Engineering Department of Washington State. He is a registered professional engineer; a diplomate of the ASEIB; a member of ASCE, AWWA and the Conference of State Sanitary Engineers; and is a Fellow of the APHA.

A native of Washington, he and Mrs. Jensen, with their three daughters, live in Seattle. He likes to hunt, fish, ski and golf—but like many of us finds time is insufficient for participation in these now-a-days, so much of his liking for sports takes the form of ardent support for the University of Washington teams and crew.

New Landmarks

In JOHN DEERE Industrial Progress

New industrial-equipment plant, Moline, Illinois

Recent expansion at Dubuque, Iowa, plant

DESIGNED to meet the ever-increasing demand for John Deere Industrial power and equipment are these latest additions to John Deere manufacturing facilities.

The brand-new industrial-equipment plant in Moline expands present extensive facilities for the manufacture of a constantly growing line of rugged, efficient equipment for all types of industry.

Expansion of the Dubuque plant is the John Deere answer to the wide and growing acceptance of John Deere Industrial Wheel and Crawler Tractors and stationary engines.

The two plants combine to supply complete, economical, and dependable earth-moving and materials-handling units to the world's industry.

JOHN DEERE

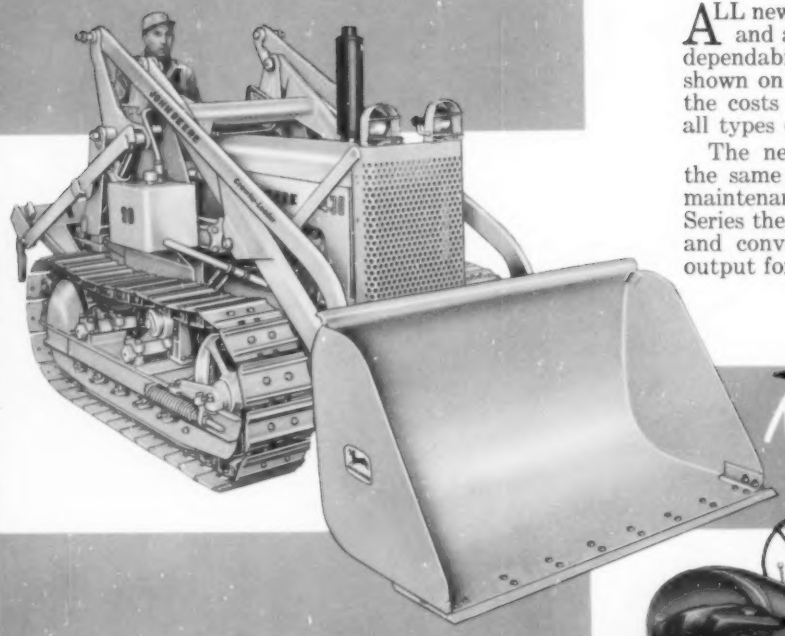
and here is what they mean to YOU

A *Newer* More Complete, CONSTANTLY GROWING LINE of Industrial Power and Equipment...

Bringing John Deere Economy and Dependability to All Industry

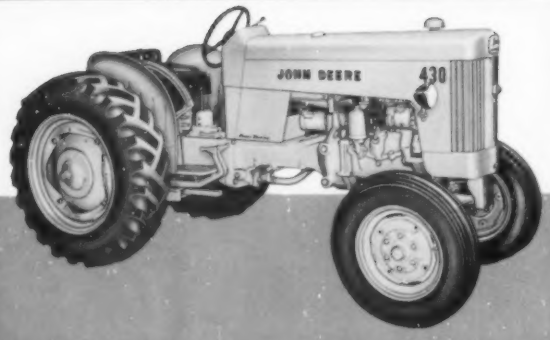
ALL new . . . all specially engineered for industry . . . and all boasting typical John Deere economy and dependability. The John Deere tractors and equipment shown on these pages are destined to bring still lower the costs of earth moving and materials handling on all types of jobs.

The new "30" Series Industrial Tractors promise the same big saving at the time of purchase and in maintenance and operating cost as the popular "20" Series they succeed—*plus* new operating comfort, ease, and convenience that mean getting still more work output for every man-hour expended.



← *New* 430 CRAWLER AND LOADER

New 830 DIESEL →



← *New* 430 and 330 UTILITY MODELS

JOHN DEERE
JOHN DEERE
Industrial
Tractors and Equipment

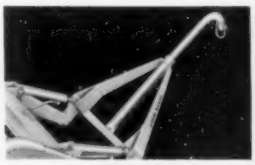
New All-Hydraulic DOZER

Tilt, angle, lift, and lower with just a touch of the levers. That's the time- and money-saving story of the all new John Deere Hydraulic Dozer. The first in its classification, this new 64 Dozer assures maximum operating control for precision work, convenience, lower earth-moving costs, and a better, faster job.

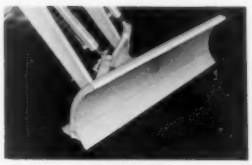
New Loader Attachments

Now—for the time-proved John Deere 71 Loader—a choice of attachments that adapt it perfectly for your particular jobs. Attachments include spill sheet, steel bucket teeth, lifting crane, and materials-handling bucket. Double-acting cylinders of the 71 provide up and down pressure or for operating in float position.

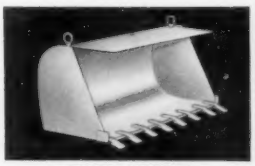
MATERIALS BUCKET



CRANE



BLADE



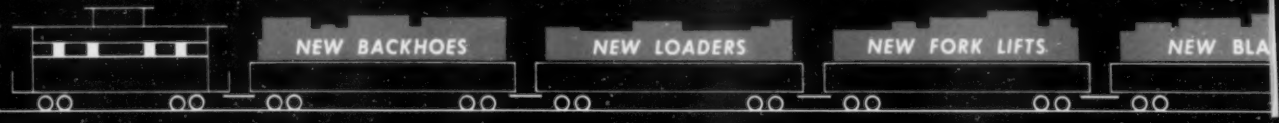
SPILL SHEET

New "840" Diesel for everyday drawbar work.

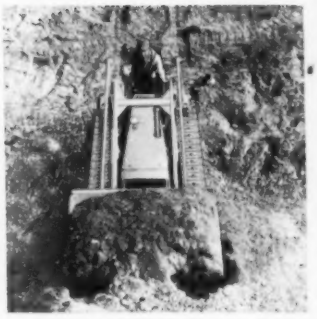
New "PIGGYBACK" SCRAPER

The new John Deere-Hancock Tractor-Scraper is a full seven-yard elevating scraper that literally lifts material into the bowl. Loading is fast and complete; controlled ejection is positive—even of sticky clay. Fifth-wheel-type of swivel drive permits operation of the elevator even on 90-degree turns, and large diamond-tread tires assure excellent traction.

.... and there's MORE on the way



Plus.... an already popular line of power and equipment to fit your field of work



See Your Nearest JOHN DEERE INDUSTRIAL DEALER

MAIL THIS COUPON for More Information and the Name of Your Nearest John Deere Dealer

JOHN DEERE INDUSTRIAL DIVISION • MOLINE, ILL.

Gentlemen: Please send me information on the items checked below and on the John Deere Credit Plan.

- ☐ Crawler-Loaders
- ☐ Wheel Tractor-Loaders
- ☐ Crawler-Dozers
- ☐ Wheel Tractor-Dozer
- ☐ Backhoes
- ☐ Winches
- ☐ Side Booms
- ☐ Fireline Plows
- ☐ Scarifiers
- ☐ Rakes
- ☐ Trenchers
- ☐ Scrapers
- ☐ Wagons
- ☐ Fork Lifts
- ☐ Crane
- ☐ Generators
- ☐ Snow Plows, Blowers, Sweepers
- ☐ Post-Hole Digger, Post Driver
- ☐ Mowers
- ☐ Concrete Mixer
- ☐ General Material Distributor
- ☐ Log Arch
- ☐ Log Loader
- ☐ Trailers

Name_____

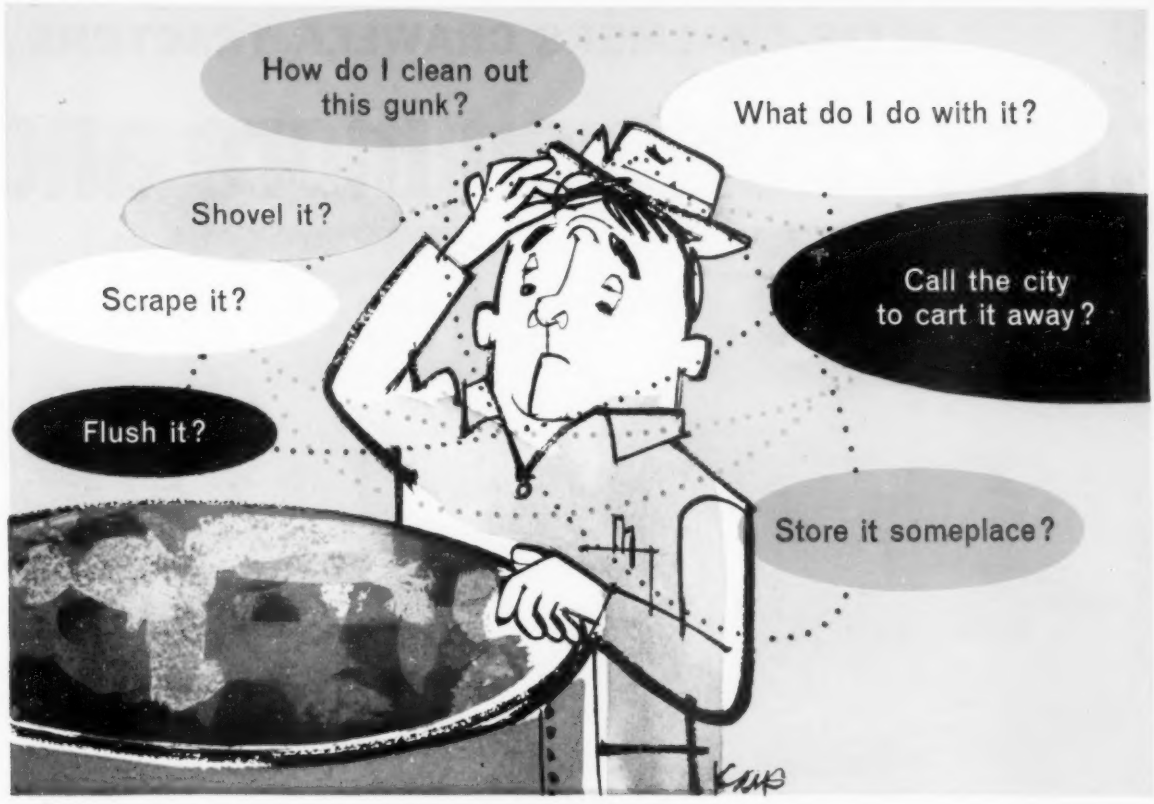
Firm_____

Address_____

City_____ State_____

John Deere Industrial dealers all over the United States and Canada stand ready to help you choose the Industrial units most economically suited to your requirements, and to give prompt, efficient service.

JOHN DEERE



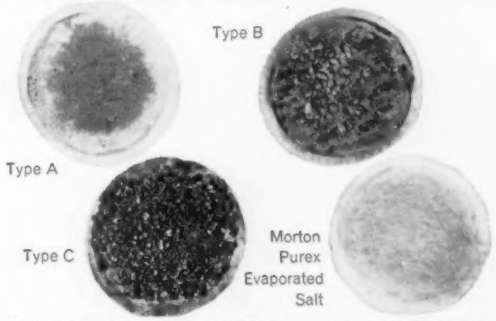
Brine tanks never need cleaning out when you use sludge-free Purex Salt

Yes, we mean never! You prevent costly shutdowns for maintenance. You save time and completely eliminate labor costs for cleaning out brine tanks. For Morton Purex Salt is 100% soluble. It will leave no accumulation of sludge—shale and sulphates—in either your brine or water-softening system.

What's more, none of your purchase price or freight bill for Purex goes toward paying for insolubles. This is an important saving, for in every 100 lbs. of ordinary salt you buy, you assume the risk of paying for up to 5 lbs. of shale and sulphates. In a 50-ton carload of ordinary salt, you may pay for as much as 5,000 lbs. of sludge. And you buy salt with "built-in" maintenance problems.

With sludge-free Morton Purex Salt, you get high-purity evaporated salt made in a controlled-particle size to prevent packing and channeling. Purex can be used in bulk wet storage systems and in the Morton Model E Brinemaker.

These filter pads (approximately 1/6 actual size) show you how much insoluble matter (sludge) you get in just 5 lbs. of various types of salt



Tests for insolubles taken from these random samples show you that Morton Purex is the only one that contains no wasteful sludge or insolubles.

For more information about Morton Purex Salt and for free, expert help on any water-softening or brine-making problem, write or wire:

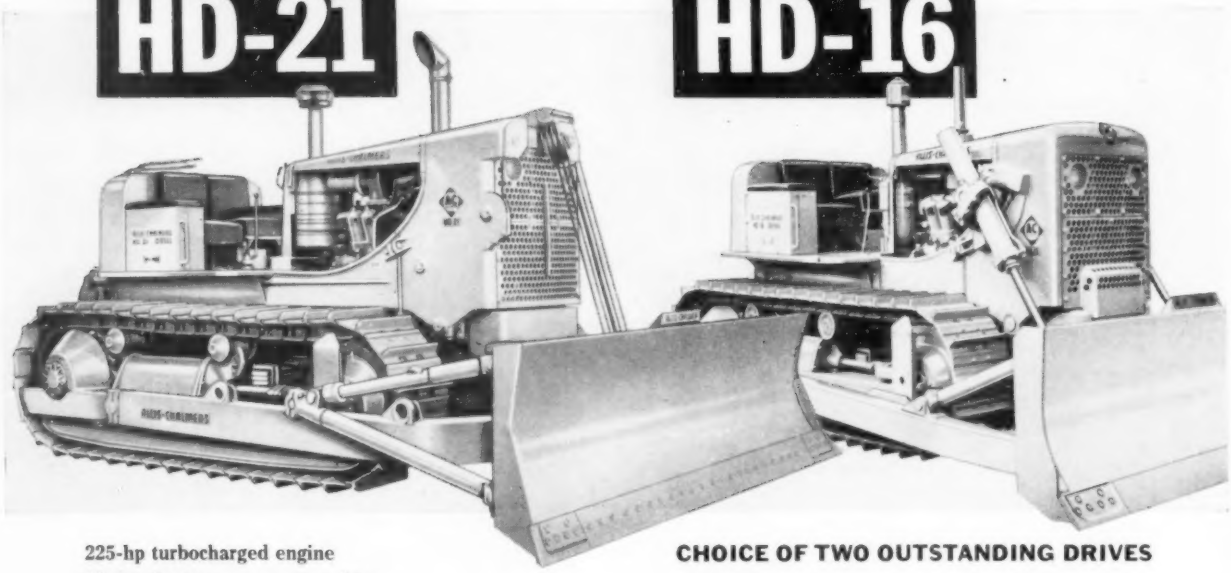
MORTON SALT COMPANY
INDUSTRIAL DIVISION
Dept. PW 10-58, 110 N. Wacker Drive
Chicago 6, Illinois

ALLIS-CHALMERS CRAWLER TRACTORS . . .

first choice on more and

ALLIS-CHALMERS HD-21

ALLIS-CHALMERS HD-16



225-hp turbocharged engine
Hydraulic torque converter drive
56,260 lb (approx. as shown)

The new HD-21 brings you live power for today's big-tractor jobs—and torque converter drive puts it to work automatically. The HD-21 offers more work capacity—dollar for dollar—than any other big crawler tractor you can buy.
HD-21A illustrated—Two other models available

CHOICE OF TWO OUTSTANDING DRIVES

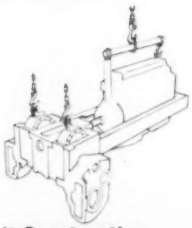
Hydraulic torque converter	All-gear drive
150 net engine hp	141 belt hp
39,090 lb (approx. as shown)	125 drawbar hp

Get up on the HD-16 yourself—and see how it handles jobs ordinarily assigned only to bigger, more expensive crawler tractors. You'll sell yourself—just as more keen-eyed construction men do every day.
HD-16DC illustrated—Five other models available

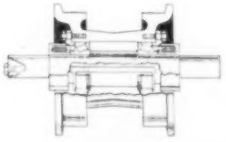
THE ONLY COMPLETE LINE OF CRAWLER TRACTORS

Pioneered and proved by Allis-Chalmers Engineering in Action

Torque Converter Drive gets more work done—automatically provides the right pull or push for every load, at maximum speed for existing conditions. *(Available in HD-21 and HD-16 only.)*



Unit Construction saves valuable time . . . lets you remove any major assembly without disturbing adjacent assemblies.



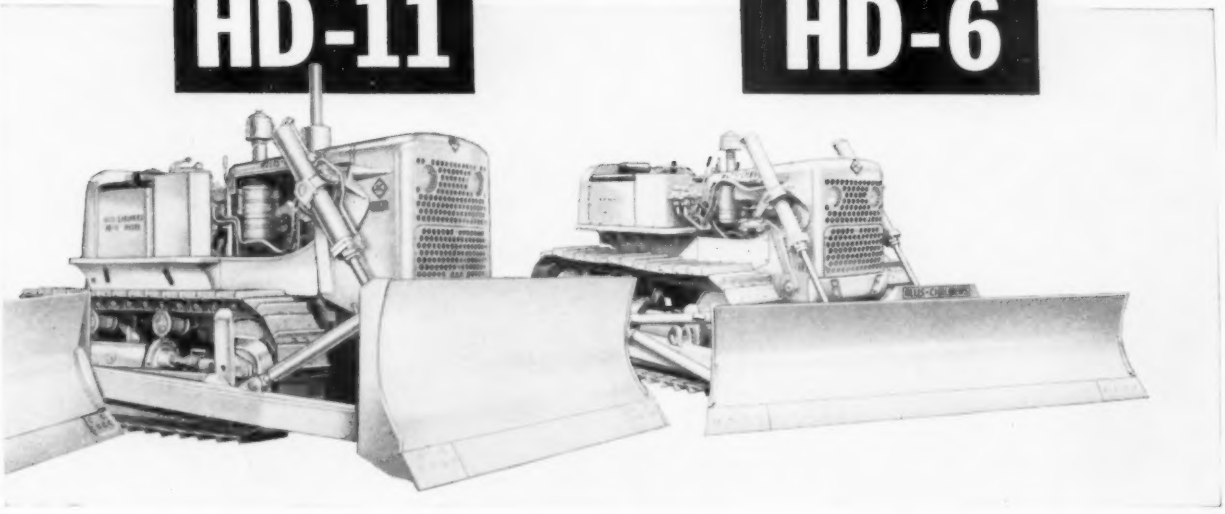
1,000-Hour Lubrication intervals for truck wheels, idlers, support rollers . . . changes daily greasing time into production time.

Look ahead...*move ahead*...and stay ahead

more tough jobs

ALLIS-CHALMERS HD-11

ALLIS-CHALMERS HD-6



94 belt hp

25,960 lb (approx. as shown)

The HD-11 is setting new standards in its size range . . . offers you dozens of work-boosting advantages, including the industry's easiest shift pattern. A single shift takes it from any forward speed to any reverse—gets short-cycle jobs done faster, easier.

HD-11B illustrated—Two other models available

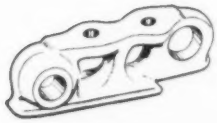
63 belt hp

16,470 lb (approx. as shown)

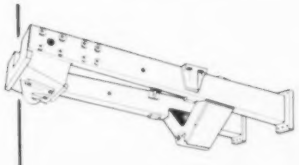
Here's up to 15,500 lb drawbar pull. The HD-6 is the only tractor near its size with big-tractor design advantages—for example, All-Steel Box-A main frame and engine-mounted dozer with direct-lift cylinders for improved weight distribution, accurate dozing and long life.

HD-6E illustrated—Three other models available

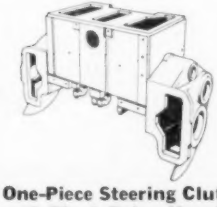
THAT GIVES YOU ALL THESE ADVANTAGES IN EVERY SIZE



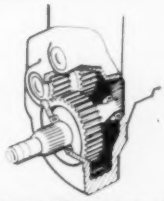
True-Dimension Track heat-treated and machined in the industry's most modern facilities, is setting new track-life records on every type of work.



All-Steel Box-A Main Frame soaks up shock and strain . . . provides improved weight distribution and equipment mounting.



One-Piece Steering Clutch and Final Drive Housing with extreme rigidity and strength . . . line-bored to provide precise alignment of gears and shafts.



Straddle Mounting of All Final Drive Gears with tapered roller bearings on both sides of short, large-diameter shafts . . . provides extra gear life.

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

with ALLIS-CHALMERS

it's NEW! the Ottawa BACKHOE now mounts on the CHEVROLET TRUCK!

WITH NEW IMPORTANT FEATURES!

• Digs 12½ feet deep • Has 190° continuous swing • Turret-type seat pivots with boom • Reverse-mounted cylinders place rods up safely from rocks and dirt • Rod-fed cylinders do away with exposed hydraulic lines • "Bite" has 7,000 lb. force at bucket edge • Two levers (dual "One-Trols") control all backhoe actions • Ejector bucket automatically forces all wet sticky material from bucket • Hydraulic laydown shifts backhoe up and over rear axle for perfect roadability • Quick on-and-off frees truck for other work in minutes!

WORK MANY JOBS — IN DIFFERENT AREAS — THE SAME DAY!

The Ottawa Truck-Mounted Backhoe is designed to meet the need of public utilities, plumbers and contractors for a COMPLETELY MOBILE DIGGER! It's an UNBEATABLE COMBINATION for

MUSCLE! The powerful hydraulic system of the Ottawa "Big Muscle" Backhoe provides EXTRA POWER for fast, smooth, economical operation!

MOBILITY! Use it anywhere, anytime . . . one job or several jobs at different locations during one day! The Ottawa WORKING UNIT is also the MOBILE UNIT ready to move anywhere with great roadability, ready for operation seconds after arrival at a new jobsite!

VERSATILITY! Dig trenches and ditches faster . . . load dirt direct from trench to truck . . . dig square graves that need no hand finishing . . . dig and maintain irrigation channels . . . clean roadside drainage ditches . . . dig building footings and septic tanks . . . use as a boom to lay lightweight pipe . . . the Ottawa Backhoe is COMPLETELY MOBILE to your needs!

Ottawa

OTTAWA STEEL DIVISION
Young Spring & Wire Corp.
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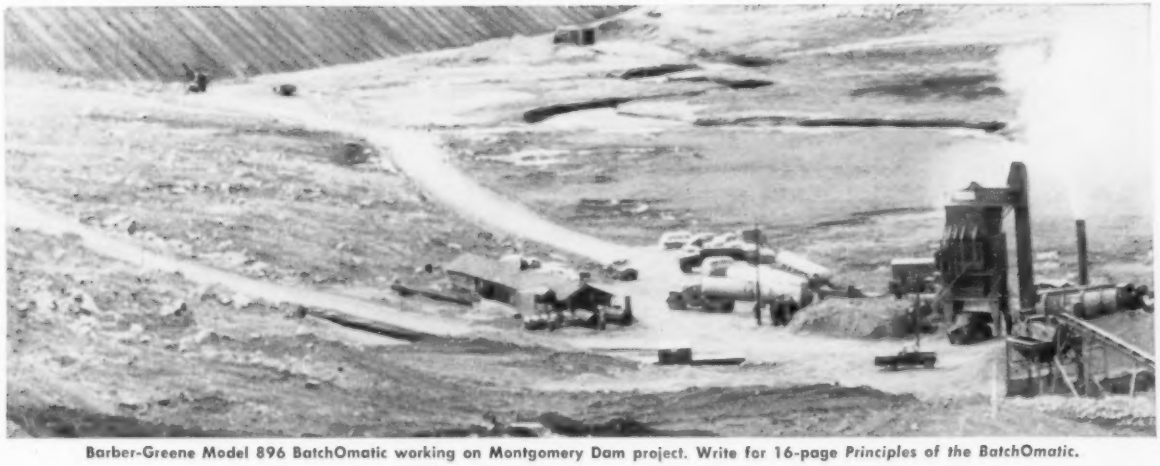
BUY the Ottawa BACKHOE and the Chevrolet TRUCK! GET the BEST BENEFITS of each . . . PLUS . . . the NEW, DYNAMIC ADVANTAGES of the COMBINATION TRUCK-BACKHOE!

This Barber-Greene Finisher paves the upstream face of the dam. Bulletin showing many other jobs available on request.

Barber-Greenes Pave Face of Montgomery Dam



Barber-Greene Model 896 BatchOmatic working on Montgomery Dam project. Write for 16-page *Principles of the BatchOmatic.*

One of the most unusual paving jobs in history was the placing of a 12-inch layer of asphaltic concrete on the upstream face of Montgomery Dam in Colorado. San Ore Construction Co., of McPherson, Kan., used a Barber-Greene BatchOmatic Plant and Finisher for the job.

Exclusive features of the Barber-Greene BatchOmatic include simultaneous weighing of all sizes of aggregate, instant change-over from automatic to manual operation, new Dyna-Mix Pugmill, instant positive inspection of aggregate gradation and weight, and real portability, as evidenced by the fact that the plant could be economically moved about 500 miles for this low-tonnage job.

The Barber-Greene Finisher is backed by unrivaled experience in laying every type of mix. Latest improvements include new transmission for faster speeds, higher-speed tamper, new crawlers, and new power unit.

Write for information on the world's most modern asphalt paving equipment. 58-5-A

Barber-Greene BG

AURORA, ILLINOIS, U.S.A.

CONVEYORS . . . LOADERS . . . DITCHERS . . . ASPHALT PAVING EQUIPMENT

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Ferri-Floc

FERRIC SULFATE

The Superior COAGULANT With The Plus FACTORS—

- Excellent taste and odor control
- Increased filter runs
- Coagulation over wide pH ranges
- Rapid floc formation
- Economy
- Turbidity removal
- Color removal
- Manganese and Silical removal
- Bacteria removal
- Ease of Operation

Ferri-Floc gives smoother, more efficient and trouble free operation. Whatever your particular water treatment problem may be, you can depend on Ferri-Floc doing a superior job and doing it efficiently and economically—Ferri-Floc is a free flowing granular salt which can be fed with few modifications through any standard dry feed equipment. It is only mildly hygroscopic, thereby permitting easy handling as well as storage in closed hoppers over long periods of time.

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Efficient coagulation of surface or well water. Effective in lime soda-ash softening. Adaptable to treatment of all industrial applications.

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Ferri-Floc coagulates wastes over wide pH ranges — It provides efficient operation regardless of rapid variations of raw sewage — Is effective for conditioning sludge prior to vacuum filtration or drying on sand beds.

SULFUR-DIOXIDE is effectively used for dechlorination in water treatment and to remove objectionable odors remaining after purification.

COPPER SULFATE will control about 90% of the microorganisms normally encountered in water treatment plants more economically than any other chemical.

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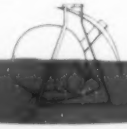

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617-29 Grant Building, Atlanta, Georgia

WATER RESOURCES DEVELOPMENT

This is an interesting and valuable book, but hard to read. It is an economic analysis of the governmental procedures used to justify and evaluate irrigation, power, navigation and flood control structures. The measures of benefits used by the various agencies are described and examined, with appropriate and enlightening comments. It is indicated that present procedures overstate benefits and understate costs to such an extent that the economic justification of many of the projects in our existing program are questionable as to their ability to raise the economic welfare of the nation. Well and soundly written, it requires concentration to understand; you can't read it while listening to the radio. The author is Otto Eckstein of Harvard University; 281 pages; numerous charts and tables; $6.50 from Harvard University Press, Cambridge, Mass.

CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

The 2 papers contained in this bulletin were presented at the 36th Annual Meeting of the HRB. The first paper, by Wayne R. Woolley, proposes certain design principles based on experience gained from existing continuously reinforced concrete pavements. The second paper, by R. L. Schiffman, I. J. Taylor and W. J. Eney, is a preliminary report on the construction procedures and investigatory details of 2 experimental continuously reinforced concrete pavements constructed by the Pennsylvania Dept. of Highways. Copies are 60¢ each and are available from the Highway Research Board, 2101 Constitution, Washington, D.C.

HIGHWAY CAPACITY STUDIES

Bulletin 167 contains 6 papers sponsored by the HRB Committee on Highway Capacity and presented at the 36th Annual Meeting. The papers are as follows: "Mass Transit in the Utilization of City Streets," by W. P. Walker and R. A. Flynt; "New Method of Capacity Determination for Rural Roads in Mountainous

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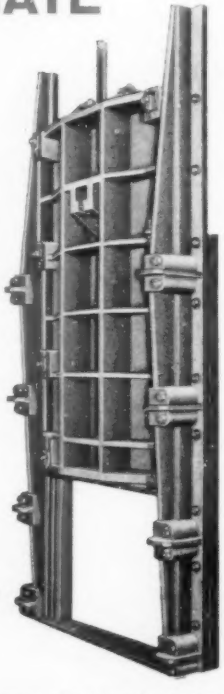
For full design and specification data, write for your copy of Catalog 75.



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Terrain," by H. C. Schwender, O. K. Norman and J. O. Cranum; "Operation of Weaving Areas," by O. K. Normann; "Pressurized Intersections," by R. C. Blumenthal and John W. Horn; "Effect of Temporary Bridge on Parkway Performance," by Matthew J. Huber; and "Trends in the 30th-Hour Factor," by William P. Walker. Copies of Bulletin 167 are $1.60 each and are available from the Highway Research Board, 2101 Constitution, Washington, D. C.

SOUTHERN PINE MANUAL

The 16th edition of the "Southern Pine Manual of Standard Wood Construction," a reference book for architects, engineers and builders is available from Southern Pine Association, P. O. Box 1170, New Orleans 4, La. Copies are $2 each.

ZONING ORDINANCES IN KANSAS

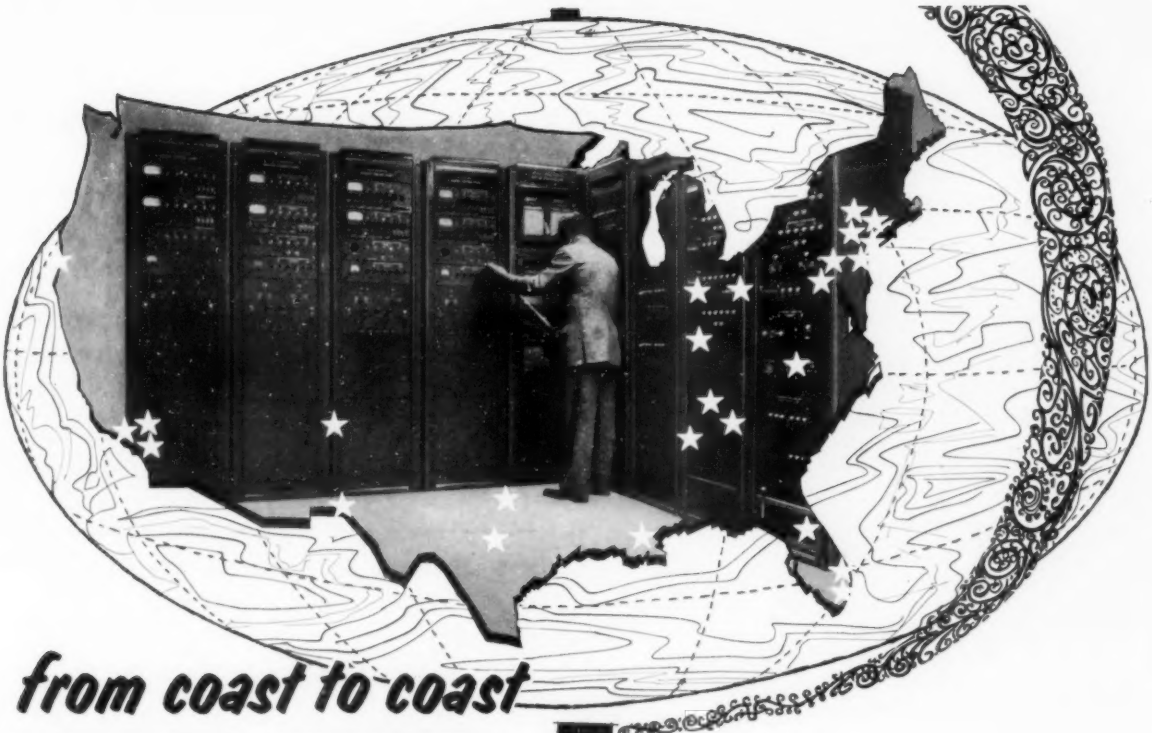
This book is a guide to the preparation, revision or interpretation of zoning ordinances in Kansas. It supplies long-sought assistance to local government officials, individual citizens, civil groups, educators and students who are striving better to understand the need for, the impact of and the methods by which zoning becomes a part of community living. Information on copies of this bulletin is available from Kansas State College, Kansas Engineering Experiment Station, Manhattan, Kans.

1958 EDITION OF ARBA'S DIRECTORY OF HIGHWAY OFFICIALS AND ENGINEERS

More than 1,700 names, titles and addresses of administrative engineers and officials in the 48 state highway departments, the District of Columbia and the departments in Hawaii and Puerto Rico are covered in this handbook. Also included are the administrative personnel of the Bureau of Public Roads, the Toll Road Authorities and the offices and directors of ARBA. The pocket-sized directory is available from the American Road Builders' Association, World Center Bldg., Washington 6, D. C., at $1 per copy.

MOVIE FEATURES BITUMINOUS PAVER

"New Concept For Paving" is the title of a new Cedarapids movie which presents an entirely new approach to the problem of laying acceptable bituminous mat at high speeds. The 24-minute movie, filmed in full color and sound, has been released by Iowa Mfg. Co., Cedar Rapids, Iowa.



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into the bell, and slide in the connecting pipe. The gasket insures a tight, permanent seal. And you can lay Tyton Joint pipe in wet trench or rain.

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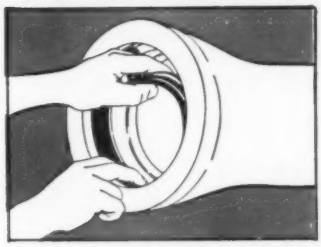
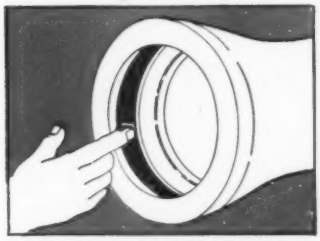
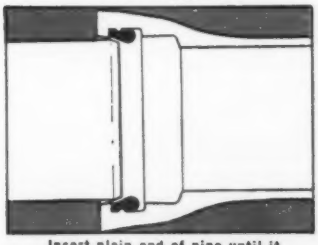


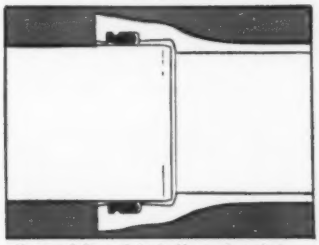
Insert gasket with groove over bead in gasket seat



Wipe a film of special lubricant over inside of gasket



Insert plain end of pipe until it contacts gasket



Force plain end to bottom of socket . . . the job's done!

Tyton Joint pipe for water main extension in Oklahoma.

EQUIPMENT and MATERIALS

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NEW LISTINGS

The engineering information in these helpful catalogs will aid you in your Engineering and Public Works programs. Just circle numbers you want on the reply card, sign and mail. This free Readers' Service is restricted to those actively engaged in the public works field of cities, counties or states.

In-Place Cement Lining of Small and Large Pipe

25. A catalog describing a process of in-place centrifugal cement lining of pipes from 4 to 144 ins. in diameter is available from the Centriline Corp., Raymond International Inc., 140 Cedar St., New York 6, N. Y. Check the reply card for sample specifications and test results.

Euclid's Entire Line of Earthmoving Equipment

31. Twenty-four different models of earth-moving equipment are pictured and described in a bulletin from Euclid Div., General Motors Corp., Cleveland 17, O. Also included are illustrations and brief descriptions of the important features to be found in each type of equipment. Check the reply card.

Aluminum For the Highway

237. The 5 advantages of Revere aluminum alloy extrusions for aluminum bridge railings are described in bulletin from Revere Copper and Brass Inc., 230 Park Ave., New York 17, N. Y. Also covered are the Revere materials that are used in panel railings and the two types of parapet railing designs. Check the reply card for full specifications in "Aluminum for the Highway."

Stationary Engines For Sewage and Water Treatment Plants

82. Engines that operate on sewage gas, gasoline, butane or natural gas are described in literature from Climax Engine Mfg. Co., Div. of Waukesha Motor Co., Clinton, Iowa. Check the reply card.

Data on the Littleford Utility Spray Tank

89. Bulletin JJ-5 gives facts and diagrams on the trailer-type spray tank which is used for repairing rural roads, patching city streets and spraying parking lots. Write Littleford Bros., Inc., 453 E. Pearl St., Cincinnati 2, Ohio, or check the reply card.

Utility Tractors For Many Jobs

94. A pictorial review of the Allis-Chalmers D-Series utility tractor line is available from Allis-Chalmers Mfg. Co., Tractor Group, Milwaukee, Wisc. Check the reply card for specifications and dimensions of the D-14 and D-17 tractors.

Blaw-Knox Concrete Paving Spreader

97. This 3-color bulletin contains 16 pages of pictures, spreader operation diagrams and data on this paving spreader. Also the automatic transverse blade and vibratory paving attachment are described. Check the reply card or write Sales Promotion Dept., Construction Equipment, Blaw-Knox Co., Mattoon, Ill., for Bulletin No. 2485R.

Construction Staking Handbook

104. An 8-page bulletin that shows the newest way to stake, spread, splice and brace forms for flat work, footings and curbs is available from Dee Concrete Products Co., 670 N. Michigan Ave., Chicago 11, Ill. Check the reply card for full details.

Metal Plate Guard Rail

112. A design kit that will simplify and improve an engineer's ability to incorporate more safety into highways, through the use of guard rail is available from Metal Plate Guard Rail Div., Steel Processing & Distribution Co., 6466 Gayhart St., Los Angeles 22, Calif.

Technical Data on Analytical and Process Microfiltration

134. In addition to the standard items of laboratory and field analytical filters and apparatus, this literature covers two new all stainless steel high volume filter holders utilizing Millipore's nylon reinforced membrane filter. Check the reply card or write Millipore Filter Corp., 36 Pleasant St., Watertown 72, Mass.

Complete Catalog on Grating and Treads

138. A 16-page catalog on open floor grating and stair treads is available from Reliance Steel Products Co., P. O. Box 510, McKeesport, Pa. Complete engineering details, form panel sizes, weights and safe loads, to surface treatments and fastening methods are included.

Rotary Positive Blowers For Sewage Treatment

145. Blowers for activated sludge and contact aeration in sewage treatment are covered in Bulletin AF-258 from Roots-Connersville Blower Div., of Dresser Industries, 900 W. Mount St., Connersville, Ind. Check the reply card for blower capacities, dimensions and pressures.

Fluorescent Sign Light Described in Spec Sheet-Bulletin

163. Line-O-Lite fluorescent fixture is suitable for highway signs, parking areas and island plazas. Write David L. Marx, Marketing & Promotion Manager, Magni-Flood Inc., 50 Crary Ave., Mt. Vernon, N. Y., or check the reply card for complete specifications.

Stone and Chip Spreader For Bituminous Roads and Streets

182. A ruggedly built one-man operating stone and chip spreader is described in a bulletin available from Temple Stone and Chip Spreader Co., 2335 Kutztown Road, Reading, Pa. Check the reply card.

Hydrogen Zeolite Softener Bulletin

153. Bulletin indicates advantages of the hydrogen zeolite process, its chemistry and variations in methods for neutralizing mineral acidity of hydrogen zeolite effluent. Check the reply card or write Cochrane Corp., Philadelphia 32, Pa., for the types of zeolites.

Waterproof Fieldbooks For Engineers and Surveyors

206. Write permanent field records under severe weather conditions with field books from J. L. Darling Corp., Browns Point, Tacoma, Wash. Check the reply card for data.

Tow-Type Bituminous Distributor

231. How this trailer-mounted distributor is used for heating and applying bitumen is covered in Bulletin 568B from Rosco Mfg. Co., 3118 Snelling Ave., Minneapolis 6, Minn. Check the reply card for descriptions and specifications.

Catalog of Traffic Control Equipment and Systems

240. Traffic controllers, pedestrian-actuated controllers and pre-emptors, accessories for all controllers, adjustable and fixed-face signals, beacons and flashers are the equipment covered in this valuable catalog from Marbelite Co., Inc., Brooklyn, N. Y. Check the reply card.

Soil Sampling Equipment For Dams, Bridges, Highways and Airports

243. Bulletin No. 300 covers several types of soil samplers augers and sample bags and jars. Check the reply card or write Sprague & Henwood, Inc., Scranton 2, Pa., for your copy.

Guides to Better Engineering Design

249. Air Survey Corp., 1101 Lee Highway, Arlington 9, Va., furnishes services on aerial photography, photogrammetric engineering and precise mapping. Check the reply card for information on this type of engineering.

New Plastic Expansion-Joint Waterstop

253. Plasti-Grip made of extruded plastic can be used as an expansion joint, construction joint or waterstop. t somes in strips 100 ft. long and 5, 6 or 9 ins. wide. Check the reply card or write Progress Unlimited Inc., 15 West 44th St., New York 36, N. Y.

Use the Reply Cards For Prompt Service

To order these helpful booklets check the reply card opposite page 38.

NEW LISTINGS (Cont.)

Trickling Filters
Built with Filter Blocks

260. A 4-page catalog describing the "Translot" filter blocks which have slots running completely across the block, providing maximum ventilation and maximum drainage, is available from Texas Vitrified Pipe Co., Mineral Wells, Texas. These blocks are made in standard lengths and assure absolute resistance to acids, alkalies and gases.

Literature on
Concrete Sewers

270. Literature on concrete sewers is available from Portland Cement Association, Dept. 10-89, 33 West Grand Ave., Chicago 10, Ill. Check the reply card for data on concrete for all modern pipelines.

Complete Facts on New
Extra Heavy Duty Trucks

272. Bulletins covering conventional and tilt cab trucks and tandem axle models are available from Ford Div. of Ford Motor Co., P. O. Box 658, Dearborn, Mich. Check the reply card.

Hydra-Drives
Power Shift Transmissions

283. With four speeds forward and reverse, the Hydra-Drives is ideally suited for vehicles which must travel in both directions during a normal work cycle. Check the reply card or write Rockwell-Standard Corp., Transmission and Axle Div., Detroit 32, Mich., for full details.

Lighting Standards for Every
Outdoor Lighting Requirement

284. Complete design details, typical installation photos and how Hy-Lite standards are made are covered in this valuable guide. Check the reply card or write to the American Concrete Corp., 5092 North Kimberly Ave., Chicago 30, Ill., for Catalog 400.

Use The Reply Card

Bulletin on
Waste Treatment Equipment

289. Equipment covered in Bulletin No. 315-11 includes bar screens, grinders, collectors, skimmers, separators and flocculation equipment. Check the reply card or write Chain Belt Co., Milwaukee 1, Wisc., for this data.

Time-Saver for
Transit Set-Ups

291. The Warren-Knight Tele-Plumb enables you to set up over (or under) a point without using a plumb bob, gives full telescope power for easy, accurate positioning. This optical device is attached to the objective end of the transit or transit-level telescope, does not need to be removed during normal use of the instrument. Full details in bulletin from Warren Knight, 136 N. 12th St., Philadelphia 7, Pa.

Accuracy In
Chemical Proportioning

296. For chlorinating swimming pools or drinking water, for feeding polyphosphates, fluorides, soda ash, alum, or acids in water treatment where precise accuracy is required, consult the literature of Precision Chemical Pump Corp., 1396 Main St., Waltham 54, Mass.

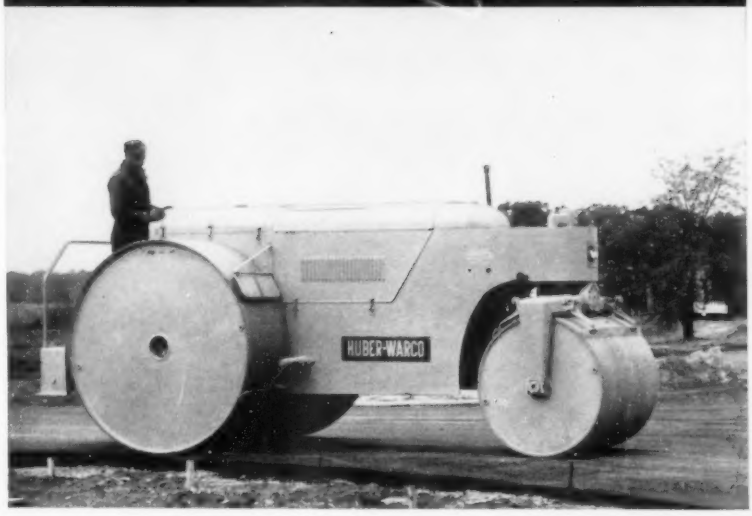
How To Build Stabilized
Heavy Traffic Pavements

300. A 16-page booklet published by Seaman-Andwall Corp., Milwaukee, Wis., shows how low cost, local materials may be utilized in the construction of heavy duty pavements. Many illustrations and well-written text give full instructions on materials and construction methods for subgrades, subbases and base courses. A worth-while booklet for every highway engineer. Check reply card for copy.

Diesel Crawler Tractor
With Power-Turn Steering

305. The OC-12 Oliver crawler tractor with 53 drawbar hp, and an inside turning radius of 25 ins. is covered in 16-page bulletin from The Oliver Corp., 400 West Madison St., Chicago 6, Ill. Check the reply card.

HUBER-WARCO 3-Wheel rollers



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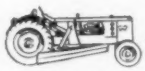
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Manual on Gray Iron Castings For Highways and Municipalities

309. Construction castings covered include catch basins, catch basin inlets and covers, manhole frames and covers and cast iron manhole steps. Check the reply card or write Brillion Iron Works, Inc., Brillion, Wisc., for your copy.

Rectangular Collectors for Settling Basins For Sewage, Water & Industrial Wastes

326. Design data and general specifications of rectangular collectors and mechanisms are covered in Bulletin No. 8W 68 available from Walker Process Equipment Inc., Aurora, Ill. Check the reply card.

Flow Switches for Signal Devices, Electric Motors and Metering Devices

328. Bulletin FS-1 covers the McDonnell line of flow switches which respond to flow of liquid in a pipeline to make or break an electrical circuit. Write McDonnell & Miller, Inc., 3500 N. Spaulding Ave., Chicago 18, Ill., or check the reply card today.

WATER WORKS

Do You Have An Independent Source of Electricity?

27. An independent source of electricity which will supply power for vital services when regular sources fail can be invaluable during emergencies. Check Kohler Bulletin KEP 56-1 which furnishes data that will help you select the plant best suited for your needs. Many models, 500 watt to 50 Kw, portable and stationary are described. Write the Kohler Co., Kohler, Wis., or use the reply card.

Elevated Tanks and Other Storage Facilities

32. Specification sheet covering elevated tank sizes and design and illustrated brochure available from the Darby Corp., Kansas City 15, Kansas.

Plastic Wash Troughs For Water Treatment

45. Leopold fiberglass-reinforced plastic wash troughs for water treatment are described in literature from F. B. Leopold Co., Zelienople, Pa. Check the reply card for data on these units that will last for years without any painting or other maintenance.

Handbook of Cast Iron Pipes and Fittings

52. Full engineering data on products of the Alabama Pipe Co., including Super De-Lavaud cast iron pressure pipe and pipe fittings, valve boxes and other municipal castings are provided in Pressure Pipe Catalog No. 54, a 196-page publication of Alabama Pipe Co., Anniston, Ala. Weights, dimensions and specifications are clearly indicated in this easy to use in reference.

Efficient Coagulation With Ferri-Floc

69. Advantages claimed for Ferri-Floc as a coagulant include wide pH range, quick floc formation, manganese removal control of certain tastes and odors plus other aids in high quality water production. Check reply card for complete Ferri-Floc data. Tennessee Corp., Grant Bldg., Atlanta, Ga.

Convenient Reference Manual Covers Cast Iron Pipe, Valves and Hydrants

76. An 80-page manual, issued by R. D. Wood Co. Independence Sq., Philadelphia 5, Pa., presents specifications for "Sand-Spun" cast iron pipe and fittings, outlines types of joints available, lists dimensions and weights in convenient tables and includes, in addition, full engineering data on the Mathews fire hydrant and R. D. Wood gate valves.

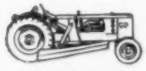
Right Angle Gear Drive For Centrifugal Pumps

107. Applications, gear drive selection tables, pulley data, efficiencies and standard dimensions of Johnson right angle gear drives are covered in catalog from Johnson Gear & Mfg. Co., Ltd., Eighth and Parker Sts., Berkeley 10, Calif. Check the reply card.

HUBER-WARCO motor graders

balanced weight and power

The Huber-Warco 6-D & 7-D MOTOR GRADER series has been designed with the right blend of weight and power to handle tough grading quickly and efficiently. A combination of torque converter, tail-shaft governor and power-shift transmission assures constant power at the blade for a greater work volume. Horsepower range of the Huber-Warco 6-D & 7-D MOTOR GRADERS is 100 to 150 h.p. Your Huber-Warco distributor would like to show you the many other features of these modern graders. Contact him today.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Valuable Bulletin on Rodney Hunt Sluice Gate

61. Sluice gate seats on a resilient rubber seal flush with the bottom of the channel and eliminates bottom wedges and the trough in which they descend. Gives design flexibility in water filtration, sewage treatment and sluices, dam, channel and chamber flow control. For complete details write to Rodney Hunt Machine Co., 82 Lake Street, Orange, Mass. for Bulletin 75, or check the reply card.

Rapid Sand and Pressure Filter Data

109. Rapid sand filters. A complete line of vertical and horizontal pressure filters, wooden gravity filters, and filter tables and other equipment. For engineering data, write Roberts Filter Manufacturing Co., 640 Columbia Ave., Darby, Pa., or check the reply card.

Engineering Data on Diatomite Filters

139. Get complete data on the Sparkler model SC-J diatomite slurry feed filter for swimming pools from the Sparkler Mfg. Co., Mundelein, Ill. Check the reply card for full information including table of filter sizes and capacities, space required and filter operation.

Complete Line of Premolded Expansion Joint Fillers

140. Expansion joint fillers for use in expansion joints in concrete are described in literature from Servicised Products Corp., 6051 West 65th St., Chicago 38, Ill. Check the reply card.

Technical Data on V-Notch Variable-Orifice Chlorinator

152. The Series A-731 chlorinator is adaptable to any type of chlorinator control and provides wide range adjustment and excellent reproducibility of chlorine flow. Check the reply card or write to Wallace & Tiernan Inc., 25 Main St., Belleville 9, N. J., for design features, flow diagrams and operation data.

Now Every Municipality Can Own a Trencher

173. The low cost of the ARPS Trench Hog, a tractor-mounted ladder type trencher makes it profitable for many municipalities to own their own trencher. Be sure to investigate this versatile machine which digs trenches to 7 feet deep, 20 inches wide. Illustrated bulletin available from Arps Corp., New Holstein, Wis. Just check the reply card.

Complete Catalog and Reference Data on Valves and Fittings

211. The entire M & H line of valves, fittings and accessories for water works, filtration, sewage disposal and fire protection are illustrated and fully detailed in Catalog 52 issued by M & H Valve & Fittings Co., Anniston, Ala. In addition to complete data on these products, there are many pages devoted to helpful engineering data. Every designer should have a copy.

Outline of Modern Water Treatment Equipment

248. Bulletin 4433 is recommended for engineers who need a basic refresher course on treatment of municipal and industrial water. It lists water impurities and methods of treatment and illustrates treatment systems and equipment. Check the reply card or write The Permutit Co., a Division of Pfaudler-Permutit Inc., 50 West 44th St., New York 36, N. Y., for your copy.

How to Select Flowmeters

273. Technical Bulletin 91-119 gives criteria for choosing the type of flowmeter to be used in measuring a given fluid or liquid. Write Fischer & Porter, 547 Jacksonville Road, Hatboro, Pa., or check the reply card for advantages and limitations of the basic types available.

Clow Bell-Tite Cast Iron Pipe

280. Laying water mains is easier, faster and more economical with Clow Bell-Tite joint cast iron pipe. Joint employs a single rubber gasket as the only accessory. Complete details available in illustrated literature from James B. Clow & Sons, Inc., P. O. Box 6600-A, Chicago 80, Ill., or check the reply card.

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Dallas, Texas, Oct. 19-23

National Safety Congress & Exposition National Safety Council
Chicago, Ill., Oct. 20-24

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Washington, D. C., Oct. 21-22

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Atlantic City, N. J., Oct. 23-25

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San Francisco, Calif., Oct. 23-25

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New York, N. Y., Oct. 26-30

World Meeting of International Road Federation
Mexico City, Mexico, Oct. 26-31

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St. Louis, Mo., Oct. 27-31

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Los Angeles, Calif., Oct. 28-31

Chesapeake Section, AWWA
Wilmington, Del., Oct. 29-31

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Hartford, Conn., Nov. 5-6

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Renew Pipe Performance With Cement Mortar Lining

322. Application of the Tate and Spunline process for cement mortar lining of existing pipe lines with a minimum of interruption of service is described, with diagrams, photographs and specifications in Catalog 15-58. Write to Pipe Linings, Div. of American Pipe and Construction Co., P. O. Box 457, Wilmington, Calif., or check the reply card.

Morton Purex Salt For Water Plants

324. Sludge-free Morton Purex salt is described in literature from Morton Salt Co., Industrial Div., Dept. PW 6-58, 110 N. Wacker Drive, Chicago 6, Ill. Check the reply card for information on this 100 percent soluble salt.

Automatic Drilling Machine For Cutting Any Type of Pipe

325. The CL-12 drilling machine may be hand or power operated and will make cuts from 2 to 12 inches through any type of pipe. Check the reply card for full details or write the Mueller Co., Decatur, Ill.

Manual on the Hersey Disc Water Meter

329. Illustrations, descriptions and specifications of Hersey water meters are covered in manual available from Hersey Mfg. Co., 250 Elm St., Dedham, Mass. Size ranges are $\frac{5}{8}$"-$\frac{5}{8}$"x$\frac{3}{4}$"-$\frac{3}{4}$" and 1". Check the reply card.

Points to Consider in Filter Sand Selection

332. Best operation of rapid sand filters requires filter media which is hard, properly shaped, carefully graded and perfectly clean. Filter sand and gravel which meets these exacting requirements is available on short notice from Northern Gravel Company, Box 307, Muscatine, Iowa.

For Prompt Service Use The Reply Card

Technical Bulletin on Swimming Pool Filtration Equipment

335. A 24-page technical Bulletin 626, designed to help persons planning pools which must comply with local and state health regulations, is now available from the R. P. Adams Co., Inc., 328 East Park Drive, Buffalo 17, N. Y. Check the reply card for data on size selection charts, typical installations and drawings.

Engineering Data on Equipment for Municipal Water Conditioning

347. For information on the design and operation of many types of water treatment plant equipment, including the Graver Reactivator, pressure filters, iron removal installations, zeolite softening and water conditioning for swimming pools get Bulletin WC-113 from Graver Water Conditioning Co., 216 West 14th St., New York 11, N. Y. Check the reply card.

Automatic Bin Level Indicators For All Bulk Materials

378. Bin level indicators for municipal water treatment, asphalt batching plants, concrete batch plants and other installations where bins are used are described in 20-page catalog from the Bin-Dicator Co., 13946 Kercheval Ave., Detroit 15, Mich. Check the reply card.

Device Used to Regulate Flows of Liquids

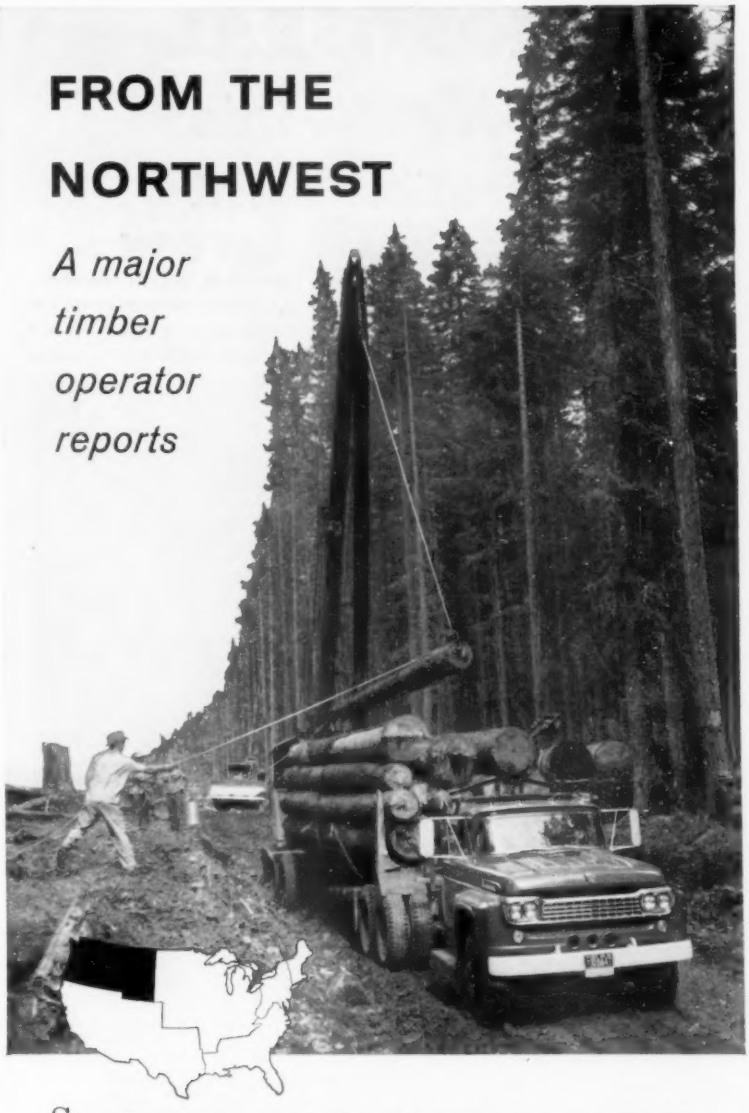
396. Valuable data on details of design, capacities, dimensions and typical installations of the Simplex Type S Controller are covered in literature from Simplex Valve & Meter Co., 7 East Orange St., Lancaster, Pa. The unit regulates flow of liquids in filter plants and is used to maintain a uniform rate of filtration through each filter unit. Check the reply card.

Data on Adjustable-Speed Magnetic Drives for Low-Lift Pumps

465. A catalog is available from Electric Machinery Mfg. Co., Minneapolis 13, Minn. that tells all about E-M Vertical Synchronous Motors and Magnetic Drive Units. Engineers check the reply card for information on this equipment for sewage pumps.

FROM THE NORTHWEST

A major timber operator reports



Steve Wilson's company hauls logs from mountainous Oregon timber stands—over crude roads with grades up to 18%.

Mr. Wilson has 43 Ford trucks and tractors that haul nearly 300,000 board feet of logs and rough lumber a day.

"I can't think of a tougher job for a truck than my operation," says Steve Wilson. "I need trucks that can take punishment and *stay* on the job. If a load of logs isn't delivered on schedule, I can lose plenty."

The tractor in the picture is a 1958 Ford T-850.

It is powered by a 534-cubic inch V-8 engine. Rear axle ratio is 6.69 to 1, wheelbase is 192 inches. It is equipped with a 5-speed main transmission and a 4-speed auxiliary, and grosses 72-76,000 pounds.

"Diesels used to walk right around us, but today it's just the opposite. This big Ford climbs a 10% grade loaded at 11 miles an hour, compared to 6 mph for our previous truck."

S. O. Wilson

President
Steve Wilson Company

THOROSEAL *Restored* this Filtration Plant

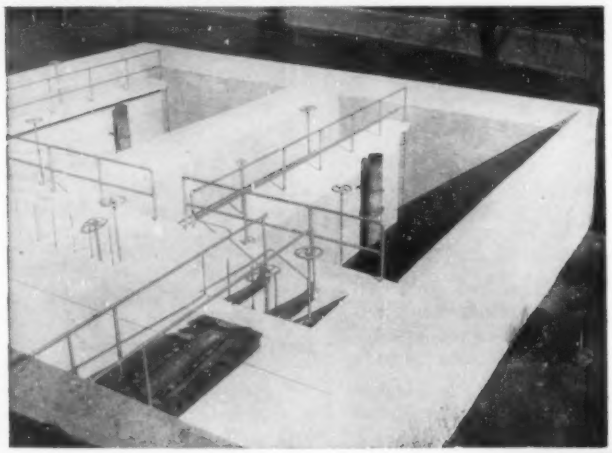
BEFORE

Example of complete break-down of masonry, due to penetration of water into body of concrete and action of frost in damp masonry.

It is amazing how THORO System products will correct a condition, such as shown in photograph. Concrete was sandblasted to remove all disintegrated material to sound concrete surface and reinforcing rods. Patching was done with THORITE Patching Mortar, bringing blistered areas to true and even lines, followed by two applications of WHITE THOROSEAL for protection.

AFTER

At minimum cost, almost ⅓ the cost of other methods, concrete restoration, patching and surface protection was completed with THORO System products on Filtration Plant in Keyser, West Virginia. Contractor: Standard Construction & Waterproofing Company, of Cumberland, Maryland.



Get our pictorially described literature "HOW TO DO IT"

STANDARD DRY WALL PRODUCTS INC.
NEW EAGLE, PENNSYLVANIA

U. S. Tyton Joint Pipe

490. An eight page booklet on centrifugally cast, Tyton Joint pipe for water or other liquids has been announced. The newly developed Tyton Joint is simple, sturdy and tight. Illustrations show details of joint and method of assembly. Write U. S. Pipe & Foundry Co. Birmingham 2, Ala., or check the reply card.

Helpful Engineering Data on Cast Iron Pipe

422. Complete data on McWane Super-DeLavaud centrifugally cast pipe with bell and spigot or mechanical joints is contained in Bulletin WP-54, issued by McWane Cast Iron Pipe Co., Birmingham 2, Ala. Size range includes 2" through 12" diameters, 18 feet long.

Floatless Liquid Level Controls

513. Catalog describes the B/W system of liquid level control, liquid level relays, electrodes, signals and alarms with descriptions, charts and diagrams of typical applications. Check the reply card or write B/W Controller Corp., Birmingham, Mich.

Plastic Pipe For Liquids and Gases

514. Kraloy rigid polyvinyl chloride plastic pipe can be used for liquids and gases and will not rust, rot or corrode. Write to Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Los Angeles, Calif., or check the reply card for complete details on this lightweight pipe.

Gas and Gasoline Engines Described in Literature

535. Roiline engines (formerly LeRoi), gas and gasoline models are built as bare engines, complete power units, and with components and accessories for special services. Check the reply card or write Waukesha Motor Co., Waukesha, Wisc., for details on the use of these engines in compressor, generator and pumping installations.

Use The Reply Card

Manual on Valves, Fire Hydrants and Accessories

559. A 244-page manual covering Darling valves and fire hydrants in a broad range of types, sizes and constructions is available from Darling Valve & Mfg. Co., Williamsport, Pa. Engineering data, application tips, valve accessories information, reference data on materials, specifications and standards are covered.

Modern Elevated Water Tanks

566. A 16-page bulletin describing 2 types of water storage tanks, the watersphere and the waterspheroid, is available from the Chicago Bridge & Iron Co., 332 South Michigan Ave., Chicago 4, Ill. Standard sizes from 25,000 gals. to 500,000 gals. are covered.

Water Measurement and Recording Instruments

582. Bulletin No. 314-1 covers water control equipment with emphasis on propeller meters and their construction features. Recorders and their application and remote controlling are also covered. Check the reply card or write Sparling Meter Co., 201 North Temple City Blvd., El Monte, Calif.

Single Gasket Type Joint For Cast Iron Pipe

602. A double-sealing gasket type joint for cast iron pipe that is easy to assemble and install is described in catalog from American Cast Iron Pipe Co., Birmingham 2, Ala. Tables on pipe from 3" to 48" are included along with recommended deflection tables. Check the reply card.

Slide Rule For Chemical Feed Calculations

627. A very handy chemical feed calculator is available from Industrial Chemical Sales Division, West Virginia Pulp and Paper Co., 230 Park Ave., New York 17, N. Y. Pounds per million gallons, grains per gallon and grains per gallon of CaO from lime are several of the calculations that can be made. Check the reply card today.

To order these helpful booklets check the reply card opposite page 38.

Manual on Valves, Fire Hydrants and Accessories

670. Complete line of Iowa valves and hydrants are covered in this manual from Iowa Valve Co., Oskaloosa, Iowa. All equipment meets AWWA specifications.

Turn Your Water Meter Reading Inside-Out

671. The Visi-Meter is a remote recording and indicator system that eliminates the need of entering the home to read water meters. It records within an accuracy of 0.1 percent. Check the reply card or write Visi-Meter, Inc., 301 North 17th St., Kansas City, Kans., for literature.

Electronic Locators for Water Mains, Services, Valves and Boxes

677. Miniaturized line locator that is encased in a molded glass fibre container and has transistors that have a rated life of 70,000 hours is described in literature from Wilkinson Products Co., 3987 Chevy Chase Drive, Pasadena 3, Calif. Check the reply card.

Flexible Plastic Pipe For Water Distribution

708. A new-type polyethylene resin flexible pipe is described in Catalog No. 401 available from Orangeburg Mfg. Co., Inc., 375 Park Ave., New York 22, N. Y. Fittings, installation, size and weight tables and physical properties are several of the sections covered.

SEWERAGE AND WASTE TREATMENT

What You Should Know About Trickling Filter Underdrains

20. Specifications for vitrified clay under drain blocks conforming to ASTM standards, suggestions for layouts and construction of trickling filter floors, dimensions of standard blocks, channel covers, angles and other fittings are available from the Trickling Filter Floor Institute c/o Editor, Public Works, 200 So. Broad St., Ridgewood, N. J. Check the reply card and we will forward your request.

A Handbook of Sewer Cleaning Methods and Materials

44. Complete easy-to-follow directions for every type of sewer cleaning operations and the equipment needed for effective cleaning work is covered in a 48-page booklet issued by Flexible Inc., 3786 Durango, Los Angeles 34, Calif. Full details are provided on power cleaning machines, the SeweRodeR, hand tools and all accessories. Water main and culvert cleaning methods are included.

Helpful Design Data For Sewage Ejectors

81. The application and advantages of pneumatic sewage ejectors are outlined in bulletin S-55 of the Blackburn Smith Mfg. Co., Inc., Hoboken, N. J. Included are piping diagrams for electrode and float switch controls plus dimensions and layouts for single and duplex systems.

Armco Smooth-Flo Sewer Pipe

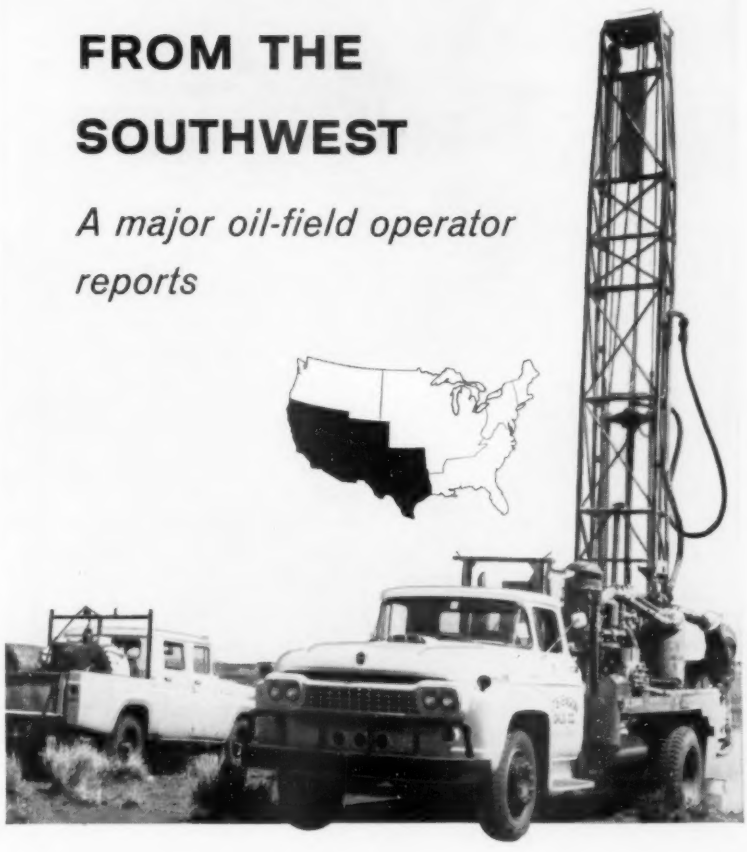
86. High flow capacity, flexible strength, durability and wide size range of a corrugated metal pipe that is paved to the full periphery of the pipe are sections covered in bulletin from Armco Drainage & Metal Products, Inc., Middletown, Ohio. Check the reply card.

Theory of Controlled Digestion With Floating Cover Tanks

88. In an excellent 40-page booklet, an authoritative discussion of digestion theory and practices, including design, operation and economics is presented by the Pacific Flush Tank Co., Chicago 13, Ill. Complete data are given on the use of floating covers, together with details on tank construction, piping and control chambers.

FROM THE SOUTHWEST

A major oil-field operator reports



This '58 Ford F-850 runs all day . . . but hardly moves at all.

It belongs to the Stevenson Drilling Company of Houston, Texas. The truck goes only a few miles a day but its V-8 engine runs all day long—powering (transmission PTO) a drill that's searching for oil. The combination air-water drill makes 100-ft. deep "shot holes." The oil company geophysicists detonate dynamite in these holes for seismograph recordings that reveal the location of new oil deposits.

"We are really impressed with the way these new Ford Super Duty V-8's are engineered," says W. M. Stevenson. "We normally drill on propane, through a truck's carburetor throat, but the fuel costs of our Super Duty V-8 turned out to be so reasonable that we didn't need to switch."

The Super Duty V-8 power plant in the Stevenson Company's F-850 displaces 401 cubic inches. It has a 5-speed transmission and a two-speed rear axle ratio of 6.50/8.87 to 1. Wheelbase is 175 inches, gross weight 23,000 lb.

"We have used Fords since 1946. We like the availability of Ford replacement parts, their low cost and the excellent Ford service. I plan on buying Ford trucks 100% in the future."

W. M. Stevenson

President
Stevenson Drilling Company

To order these helpful booklets check the reply card opposite page 38.

Sewer Design Flow Chart Based on Manning Formula

154. A large-scale, convenient flow chart based on the Manning formula, together with typical examples of use, is available from Johns-Manville, 22 East 40th St., New York 16, N. Y. To get your copy check the reply card or write to the manufacturer and ask for Bulletin TR-94A.

Get Data Now on This Catch Basin Cleaner

198. Simple powerful pneumatic bucket is featured by Netco Catch Basin Cleaner. Folder 33A gives details and illustrates operation of complete self powered truck mounted unit, Netco Div., Clark-Wilcox Co., 118 Western Ave., Boston 34, Mass. Check the reply card.

Dorr-Oliver CompleTreator For Small Sewage Plants

266. An 8-page, 2-color bulletin that describes the Dorr-Oliver CompleTreator is available from Dorr-Oliver Inc., Stamford, Conn. Check the reply card for line drawings, flow diagrams and a series of photographs showing the step-by-step installation of the unit.

How to Dispose of Sewage and Industrial Sludges

281. Get full information on the C. E. Raymond System of combined incineration and sludge drying providing high temperature deodorizing for nuisance-free sludge disposal. Flexible layouts fit large and small communities. Use handy reply card or write Combustion Engineering Inc., Raymond Div., 1315 No. Branch St., Chicago, Illinois.

Centrifugal and Turbine Type Pumps For Water and Sewage Plants

321. Turbine-type pumps, close or flexible couple drive, side suction centrifugal pumps and mixed flow pumps are described in Catalog M available from Aurora Pump Div., The New York Air Brake Co., Loucks at Dearborn, Aurora, Ill. Included is a pump selection guide and spigot pipe. Check the reply card.

Bitumized Fibre Pipe For Sewer Connections

172. Bermico pipe for house to sewer or house to septic tank connections is described in literature from Brown Co., 150 Causeway St., Boston 14, Mass. Check the reply card for full details.

Engineering Layouts For Walking Beam Flocculation Units

306. Covered in this design bulletin are sections on drive locations, flocer spacing, trough spacing, designs and sizes, and specifications of the flocculation mechanisms. Check the reply card or write Stuart Corp., 516 N. Charles St., Baltimore 1, Md., today.

How Your Filter Washing Can Be Improved

368. More effective sand washing with elimination of mud balls and bed cracking with resultant longer filter runs are claimed for the Palmer Filter Red Agitator, described in bulletins issued by Palmer Filter Equipment Co., Erie, Pa. Check the reply card.

Pneumatic Sewage Ejector Pumping Systems for Low Flows

317. Dimension and capacity tables for pneumatic float or electrode controlled ejectors, cast iron or welded steel, covering flow ranges of 20 to 600 gpm, including all information necessary in design are given in Bulletin No. KSM-2 3/58. Check the reply card or write Komline-Sanderson Engineering Corp., 101 Holland Avenue, Peapack, N. J.

Complete Story of Rubber as a Coupling Medium in Pipelines

295. "Joint Enterprise", a booklet describing Tylox rubber joints for coupling pipe used in sewerage, drainage and waterworks projects is now available from Hamilton Kent Manufacturing Co., 7 West Grant St., Kent, Ohio. The booklet also contains illustrated case histories of Tylox-Jointed installations, and suggestions to assist engineer in specifying Tylox joints for both tongue and groove, and bell

Vitrified Clay Floor System For Trickling Filters

452. The IMCO two unit floor is noted for its mechanical strength, simplicity of construction and large percentage openings for aeration. The units are self spacing and easily set in place. Check the reply card or write Industrial Materials Co., Somerset St. and Trenton Ave., Philadelphia 34, Pa., for complete catalog.

Torque-Flow Sewage Pump For All Phases of Sewage Treatment

496. Bulletin No. P10-B26 describes the operation of the Wemco torque-flow sewage pump and covers typical installation set-ups. Check the reply card or write Western Machinery Co., 650 Fifth St., San Francisco, Calif., for complete details.

Complete Treatment Unit for Handling Flows to 0.5 MGD

503. Developed for sewage flow characteristics of small communities, the Aerator-Clarifier is a complete treatment unit utilizing automatic balance of activated sludge solids with sewage flow. Bulletin 129, issued by the Chicago Pump Co., 622 Diversey Parkway, Chicago 14, Ill., describes application of this unit. Check the reply card.

Underdrains—Hidden But Important Filter Components

549. "Armcre" filter underdrain blocks are one-piece units made of vitrified salt-glazed clay. Ducts occupy 50% of floor cross section and air openings aggregate 24% of floor area. Described in several leaflets and data sheets available from Ayer-McCarel Clay Co., Brazil, Ind. Check the reply card.

Press-Seal Rubber Gaskets to Seal Joints of Concrete Pipe Sewers

623. Rubber gaskets for sealing the joints of concrete sewer pipe are described fully in literature available from Press-Seal Corp., P. O. Box 482, Fort Wayne, Ind. Check the reply card for information on how these gaskets prevent water infiltration in sewer lines.

- LINCOLN PARK VILLAGE POOL, Tonawanda, New York, 329,280 gallons
- Engineers: Krehbiel & Krehbiel, Kenmore, New York
- Filters: 2-SPF-129 R. P. Adams Company, Inc.

Shown is a typical Adams SPF Swimming Pool Filter installation. These filters are available in a wide range of sizes for pools of 50,000 to several million gallons capacity. All sizes are normally available from stock. We do not offer a filter for backyard pools.

HERE'S WHY MANY CITIES INSIST ON

ADAMS

Swimming Pool Filters

- **LOWER INSTALLATION COSTS** because it takes only a fraction of the floor space of sand filters . . . does not require massive concrete foundations.
- **TROUBLE-FREE OPERATION** . . . you never have to disassemble it for cleaning . . . as one city engineer said, "Yours is the only diatomite filter with backwashing that works".
- **PERMANENT PORO-STONE MEDIA** is inert to chemical corrosion and electrolytic action of chlorinated water. —All Adams SPF filters now in service are still equipped with the original tubes.
- **QUALITY IN EVERY PART** . . . stainless steel support rods and nuts for the tubes . . . galvanized forged steel closure plates and clips . . . *three* coats of vinyl plastic lining on sand blasted inner surfaces.

The R. P. Adams Company is the nation's largest manufacturer of filters exclusively for municipal, commercial and institutional pools.

For detailed information, write for our new technical Bulletin 626. It was prepared to help you with your swimming pool filter problems.

Our diatomite filters for municipal water supplies is discussed in Bulletin 651. Ask for it at the same time.

R. P. ADAMS CO., Inc. • **228 East Park Drive, Buffalo 17, N. Y.**

To order these helpful booklets check the reply card opposite page 38.

Amvit Mechanical Jointed Clay Pipe

298. The new Amvit jointed vitrified clay pipe in sizes 4 through 24 inches with the true "built in" mechanical joint ready for immediate and easy installation is infiltration and root-proof. Offers better flow and less maintenance and permits deflection and absorbs shocks. It is furnished on all standard fittings and permits immediate backfilling and testing. For literature write to American Vitrified Products Co., National City Bank Building, Cleveland, Ohio, or check the reply card.

Manual on Solving Drainage Problems

554. A 74-page Manual on the problems of drainage and drainage materials is available. Design section includes determining culvert lengths and sizes, run-off calculations, excavation of base and backfilling data. Check the reply card or write Bethlehem Steel Co., Bethlehem, Pa., for this valuable book.

Grit Collecting And Grit Washing Equipment

580. This 28-page book on grit collecting and grit washing equipment is profusely illustrated and contains data on 7 types of grit collectors, 2 grit washers and the Tritor screen. Detailed drawings and specifications are included to assist the engineer in the preparation of drawings. For your copy of Book 2571 check the reply card or write the Link-Belt Co., Colmar, Penn.

Biosorption Activated Sludge Plant

654. The "Biosorption" plant treats sewage and industrial wastes by a high rate activated sludge process. Flow diagrams, equipment and design of plants are covered in bulletin from Infilco Inc., Tucson, Ariz. Check the reply card.

"Packaged" Electric Power For Mobile Installations

656. A well-illustrated 8-page bulletin describing 3 Onan "packaged" power systems is available from D. W. Onan & Sons Inc., Minneapolis 14, Minn. Illustrated are battery charging with AC power, high battery charging output and battery charging only.

Controls For Use in Pumping Stations and Sewage Plants

662. Single and multi-pump sump controls, pressure operated for use in pumping stations and sewage disposal plants are described in literature available from Healy-Ruff Co., Water Level Controls Div., 2255 University Ave., St. Paul 14, Minn. The two principal types of pressure operated sump controls are covered along with general descriptions and features.

Catalog on Steel Grating

665. New ideas in flooring, walkways, stair treads, platforms and shelving are covered in Catalog 2527 available from Blaw-Knox Co., Dept. W., Pittsburgh 38, Pa. Check the reply card for information on choice of cross bar and bearing bar designs and spacings.

Underdrain Blocks For Trickling Filters

730. "Natco Unifilter" salt-glazed blocks for underdrains for trickling filter beds are balanced in size and weight for easy handling. Typical construction details for trickling filters of 20 to 160 ft. diameter are contained in a 16-page bulletin UF-3 from Natco Corp., 327 Fifth Ave., Pittsburgh 22, Pa. Check the reply card.

Jeffrey Sanitary Waste Grinders

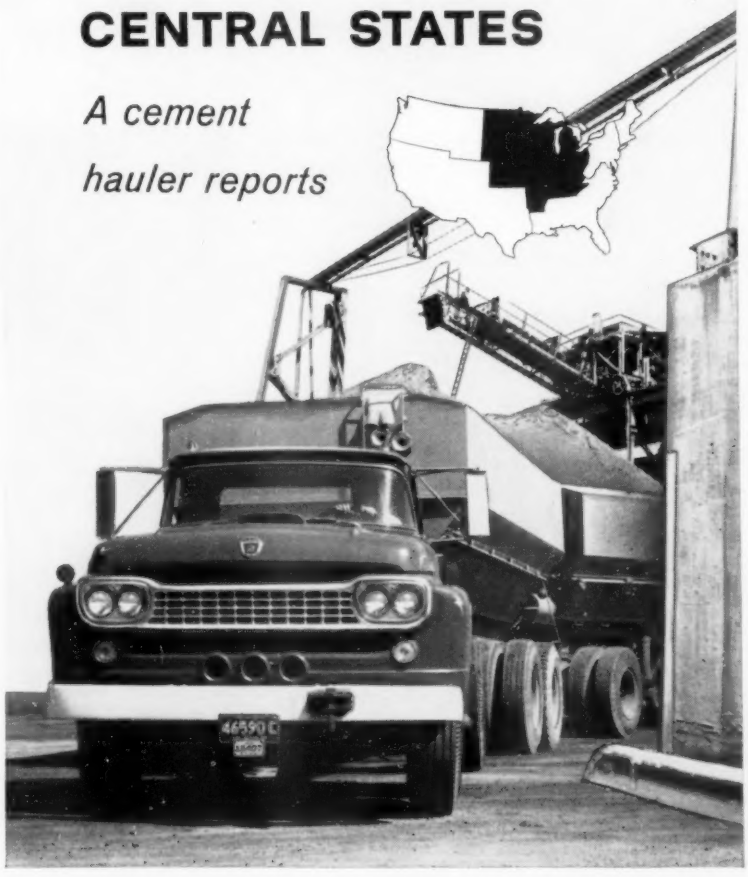
759. Literature on Jeffrey sanitary waste grinders for municipal airports is available from The Jeffrey Mfg. Co., Columbus 16, Ohio. Types, models and schematic drawings are included. Check the reply card.

Chemical to Control Sewage Odors

726. Cloroben is a sanitation chemical that provides control of sewage odors in treatment plants, septic tanks, cesspools and chemical toilets. Write Cloroben Chemical Corp., 115 Jacobus Ave., South Kearney, N. J., or check the reply card for applications and performance data.

FROM THE CENTRAL STATES

A cement hauler reports



Carl Harrison, Inc., is a limited common carrier of bulk cement operating out of Dearborn, Michigan. The Ford F-1100 shown above is the biggest of the firm's six Ford trucks.

This F-1100 grosses 98-100,000 lb. pulling doubles. Payload is 64,000 lb. (170 barrels of cement). Company President Carl Harrison makes the point that the low curb weight of Ford trucks allows him to carry bigger payloads. "The curb weight of this Ford tractor is almost half a ton less than another make we have used on this job."

Carl Harrison's shrewd appreciation of efficient, economical equipment is further evidenced by the fact that his bulk cement semi-trailers are custom-built to his own design.

Additional specifications of this F-1100: 534-cu. in. Super Duty V-8, 5-speed transmission, 2-speed rear axle, 144-in. wheelbase.

"And as far as power is concerned, this big Ford has really got it. She saves time on every trip, time that means money to us."

Carl Harrison

President
Carl Harrison, Inc.

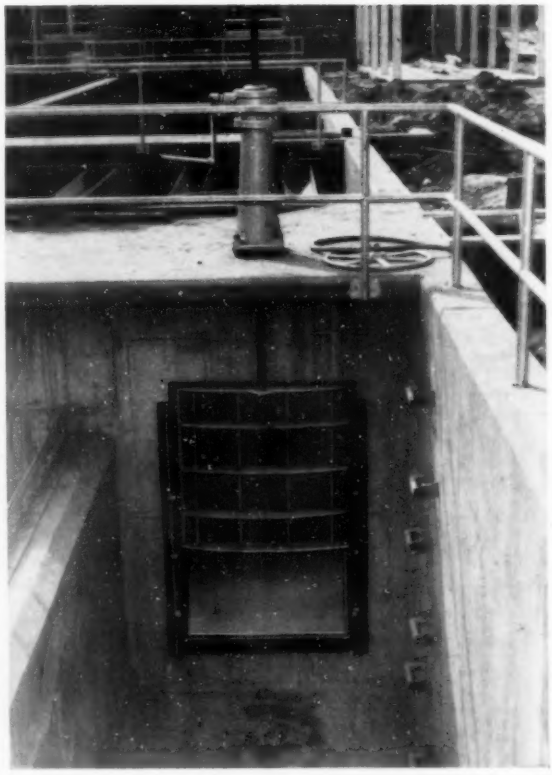
ARMCO GATES control flow at new Owensboro sewage plant

Armco Gates have an important role in a new $2.8 million primary sewage treatment plant at Owensboro, Kentucky. This plant is designed to handle an average flow of 7.5 million gallons a day, or a maximum peak flow of 30 MGD.

Included in the new plant are two 42-inch square Armco sluice gates to control discharge from the settling basins. A battery of Armco light duty slide gates controls and distributes the incoming flow. And an 8-inch square Armco Gate controls cross flow between the settling tanks.

These are typical of the many uses for Armco Gates. You too can find the answer to your sewage or water control problems from the more than 600 sizes and models of Armco Gates.

For more information, fill out and mail the coupon below for your copy of "Armco Gates for Efficient, Trouble-Free Water and Sewage Control." Armco Drainage & Metal Products, Inc., 4538 Curtis Street, Middletown, Ohio. Subsidiary of Armco Steel Corporation. Export: The Armco International Corporation.



Armco Drainage and Metal Products, Inc.
4538 Curtis Street, Middletown, Ohio

Send me the folder, "Armco Gates for Efficient, Trouble-Free Water and Sewage Control." I am interested in Armco Gates for the following uses:_____

_____

_____

NAME_____

ORGANIZATION_____

STREET_____

CITY_____ ZONE____ STATE_____

ABOVE: This 42 by 42-inch Armco Gate controls discharge from settling basin at new Owensboro sewage treatment plant.

RIGHT: Armco Gate, 8 inches square, with a non-rising stem controls cross flow between settling tanks.

ARMCO®

To order these helpful booklets check the reply card opposite page 38.

STREETS AND HIGHWAYS

Levels Sidewalks and Curbs Quickly and Easily

29. How the Mud-Jack Method for raising concrete curb, gutter, walks, streets and factory floors solves problems of that kind quickly and economically without the usual cost of time-consuming reconstruction activities—a 16 page catalog by Koehring Division, 3026 W. Concordia Ave., Milwaukee 16, Wis. Check the reply card.

Get Full Data On Aggregate Spreaders

34. Accurate control for spreading asphalt, crushed rock, chips, sand or ice control materials is featured by all models of Highway Equipment Co. materials spreaders. Data on towed, truck mounted and tailgate types available by checking the reply card. Highway Equipment Co., 630 D. Ave., Cedar Rapids, Iowa.

Tractor Loader Can Be Converted Into Eight Different Machines

38. Multiple-purpose tractor loader can be converted to a street sweeper, backhoe, fork lift, angle dozer, crane and rotary broom in a short time. Check the reply card or write Massey-Ferguson Industrial Div., 1009 South West St., Wichita 13N, Kans., for well illustrated catalog.

Automatic Sample Driver For Sub-Surface Exploration

49. This compact portable drilling unit features augering, driving and core drilling for sub-surface exploration. Check the reply card or write Penndrill Mfg. Div., Pennsylvania Drilling Co., 1201-1205 Chartiers Ave., Pittsburgh 20, Pa., for full information.

Useful Attachments for "Payloader" Tractor Shovels

95. Increased versatility for Hough "Payloader" tractor shovels is made possible by the various attachments described in literature of the Frank G. Hough Co., 761 Seventh St., Libertyville, Ill. Illustrated and described are rotary "V" and trip-blade snow plows, hydraulic backhoe, back-filler blade, pickup sweeper, scarifier teeth, winches, etc.

Non-Electric Traffic Control Products

156. Reflective pavement marking glass beads, Cataflex "202" reflective coating, Cataline reflective striping, Catatherm reflective plastic striping, plain and reflective street and highway signs, plain and reflective street name signs are covered in literature from Cataphote, Corp., P. O. Box 2066, Jackson, Miss.

Trenching Equipment Data Conveniently Assembled

212. The entire line of Cleveland trenching and backfilling equipment is now covered in a single bulletin, with material arranged for quick comparison of capacities, specifications and dimensions of all models. Twenty-four action photos graphically illustrate various job applications. Get Bulletin S-120 now for easy review of your trenching equipment needs. Just check the reply card or write to the Cleveland Trencher Co., 20100 St. Clair Ave., Cleveland 17, Ohio.

Handbook of Castings For All Public Works Construction

220. Every type of construction casting needed by engineers and contractors in the public works field will be found in a 136-page catalog issued by Neenah Foundry Co., Neenah, Wis. Detailed illustrations and complete tables of dimensions will help the designer and materials buyer.

How to Solve the Brush Disposal Problem

277. Fitchburg Chippers, engineered to solve the brush disposal problem reduce troublesome brush and trimmings to tiny, easy to-dispose-of chips. Several models are available to meet your needs. May be mounted on truck body or on trailer, tractor or jeep. Full details in interesting, profusely illustrated 16 page bulletin. Write Fitchburg Engineering Corp., Fitchburg, Mass.

FROM NEW ENGLAND

A nationally operated dairy reports

"Milk and dairy products make highly concentrated loads," says Elnathan Mitchell, President of Mitchell Dairy. "We need a bigger, stronger tractor than usual for our gross of about 50,000 lb. We decided to try a new Ford Tilt."

Mitchell Dairy, an affiliate of The Borden Company, has headquarters in Bridgeport and serves almost the entire state of Connecticut. The dairy's Ford C-1000 Tilt is on the job seven days a week, hauling canned and bottled milk from Bridgeport to outlying distribution plants.

This big Ford operates both in heavy city traffic and on expressways. Comments of drivers: "She makes it really easy to handle trailers in tight areas". . . "There's practically no shifting once she gets up to cruising speed". . . "Outpulls any tractor in the fleet."

Mitchell's Ford C-1000 Tilt Cab tractor has a 477-cu. in. V-8, five-speed transmission, 6.71/9.13 to 1 two-speed rear axle ratio, 99-inch wheelbase.

"We bought this Ford Tilt Cab truck chiefly because of its maneuverability and its low curb weight—over 1,000 lb. lighter than competitive tractors. That means our legal payload can go better than 30,000 lb."

Elnathan Mitchell

President
The Mitchell Dairy Company

To order these helpful booklets check the reply card opposite page 38.

Complete Specifications on Aluminum Fencing

327. Chain link fence of Alcoa aluminum for highways, divider strips and rights-of-way have 30 rust-free years without painting. Check the reply card or write Aluminum Company of America, 2147-F Alcoa Bldg., Pittsburgh 19, Pa., for File 14-K that contains complete specifications and technical data.

Information on Boring Machines

363. General operating instructions for the Earthworm boring machine, a portable compact unit for underground installation of pipe and conduit are available in new bulletin just released by Earthworm Boring Machine, Inc., P. O. Box 1100, Santa Monica, Calif. Suggested procedures for installing pipe or conduit and a price list are included.

Ottawa Truck-Mounted Backhoe For Chevrolet Trucks

486. Designed for complete mobility as well as digging ability, the unit travels at regular truck speeds and digs 12½ ft. deep in any position of a 190° arc. Check the reply card, or write Ottawa Steel Div. Young Spring and Wire Corp., Ottawa, Kansas.

Reflectorized White or Yellow Crosswalk Markings

578. Crosswalk markings of Perma-Line, the quick setting line that is easily applied, trouble-free, economical, and which outlasts paint 6 to 8 times, is described in literature of the Veon Chemical Corporation, 22-09 Bridge Plaza North, Long Island City 1, N.Y. Available in reflectorized white or yellow. Tests under your local conditions are invited.

Warn Lock-O-Matic Hubs Manual

618. Warn Hubs make 4-wheel drive more useful, because they make it into a "free-wheeling" 2-wheel drive, as well as a 4-wheel drive. The Lock-O-matic hubs reduce front end wear, engine load and gear whine. Check the reply card or write Warn Mfg. Co., Riverton Box 6064, Seattle 88, Wash.

Hydraulic Backhoe For Many Makes of Tractors

456. A backhoe that digs sewer systems, culverts, water mains, foundations and ditches is described fully in literature from Henry Mfg. Co., Inc., 1700 N. Clay St., Topeka, Kans. Check the reply card for specifications and details.

Pre-Assembled Dowel Units For Highway and Airport Construction

537. Laclede dowel assemblies for expansion, contraction and construction joints are precision welded into one unit and are maintained in rigid alinement. For full details write Laclede Steel Co., St. Louis, Mo., or check the reply card today.

Use The Reply Card

Aluminum for Complete Line of Signs and Sign Blanks

675. Valuable information on aluminum's advantages, features and economies, plus details on application of all sign message materials are covered in the aluminum sign bulletin from Kaiser Aluminum & Chemical Sales, Inc., Dept. MU-936, 919 N. Michigan Ave., Chicago 11, Ill. Check the reply card today.

Reflective Pavement Marking

685. Centerlite reflective compound has the beads already in the mixture and you apply the stripe in one pass on the pavement. Check the reply card or write Minnesota Mining & Mfg. Co., Dept. QV-28, St. Paul 6, Minn., for full details.

Overlaid Plywood For Highway Signs

764. Highway signs that are made of overlaid plywood that will not bend, crack or rust are described in literature from Simpson Logging Co., 2301 N. Columbia Blvd., Portland 17, Oregon. Check the reply card for data on both medium and high density plywoods.

CONSTRUCTION EQUIPMENT AND MATERIALS

Heavy-Duty Pipe Cutter Works In or Out of Trench

164. Built to stand the most severe service, the all-purpose Ellis & Ford pipe cutter, for cast iron water mains 4" through 12", is easy to use in tight places, works in or out of trench. Full details on cutter and interchangeable parts in Catalog 39, available by checking coupon. Ellis & Ford Mfg. Co., Ferndale 20, Mich.

A Fully Rotary Compressor by Jaeger

209. Complete information is available from The Jaeger Machine Co., Columbus 16, Ohio on this 2-stage, oil-cooled rotary compressor. Features include 80% fewer moving parts, up to 30% less weight, vibrationless operation and 100° cooler air.

Convertible ½-yd. Hydrohoe, Hydroshovel and Hydrocrane

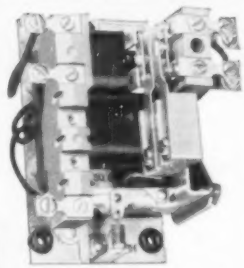
338. The Bucyrus-Erie H-5 Hydrohoe combines high production with mobility and flexibility. Check the reply card or write Bucyrus-Erie Co., South Milwaukee, Wisc., for details on this unit that can be converted to a crane, clamshell, backhoe and shovel.

Power Shovel, Crane and Backhoe All in One Unit

441. A completely hydraulic backhoe, shovel loader and crane all in one unit is described in literature available from the Badger Division of Warner & Swasey Co., Winona, Minn. Also information on front-end loaders, truck and trailer mounted hydraulic backhoes and various attachments that are useful for contractors, municipal and county engineers and state highway engineers. Check the reply card.

LIQUID LEVEL CONTROL

● Accurate! Automatic! No floats! No moving parts in liquid. Pioneered by B/W in 1933. Controls not affected by temperatures, pressures, acids, or caustics. Remote control if desired. Ice free electrodes when necessary.



WRITE for NEW CATALOG

Describes liquid level relays, electrodes, signals, alarms and alternators. Complete descriptions, charts and diagrams. Shows panels for liquid level and industrial controls. Full of valuable information . . . Write, wire or phone.

B/W CONTROLLER CORPORATION

2224 East Maple Road, Birmingham, Michigan

snow plows

select and sell from a complete line of . . .

"V" PLOWS	from 8' to 9½' swath - nose heights 30" to 48"
WINGS	10' to 12' - partial or complete hydraulic control
TAPER PLOWS	9' to 12' length of cutting edge - full range of heights - reversible and adjustable or one-way
STRAIGHT PLOWS	reversible - 9' to 12' length - heights from 29" to 42"
COMBINATION PLOWS	hydraulic control in cab converts right hand taper to "V" and to left taper while in motion

plus custom designs and sizes

for additional information write
THE GLEDHILL ROAD MACHINERY CO.
Galion, Ohio

Manual on
Coatings to Stop Rust

235. Primer type, short oil type, heat resistant, chemical resistant and floor coatings are a few of the items covered. Also complete data on Rust-Oleum products are included. Check the reply card or write Rust-Oleum Corp., Evanston, Ill., for this valuable manual.

Portable Hot Asphalt
Paving Repair Unit

250. Maximum economy in paving repair and maintenance is claimed for the compact "Patchmobile" which has a rotary tube continuous dryer, batching hopper for accurate proportioning, twin hot asphalt tanks, heat jacketed pugmill, tool heaters and hand spray bar. Get latest data from Wylie Mfg. Co., 5926 N. W. 39th St., Oklahoma City 12, Okla. Use the reply card.

High Capacity
Continuous Mix Asphalt Plants

334. A 34-page, 3-color catalog describes all of the components of Barber-Greene's Model 848 continuous-mix asphalt plant. Check the reply card or write Barber Greene Co., Aurora, Ill., for information on the mixer, several varieties of dryers, dust collectors, elevators and bins.

4-Wheel Drive
Tractor Loaders

434. A 16-page Catalog, No. 1033-5-57, describing the "Tracto-Loader Line" of front end wheel loaders is available from Tractomotive Corp., Deerfield, Ill. Covered are the five models that are in production.

Convenient Data on
Tandem and 3-Wheel Rollers

449. This manual covers everything on the variable weight, 5-8, 8-10, 8-12 and 10-14 ton tandem rollers and on the standard and variable weight, 8, 10, 12, 14 ton and 8-10, 10-12, 12-14 ton 3-wheel rollers. Covered are the frame, transmission, final drive, front end and operator's controls. The designs, construction, performance and service of the rollers are fully outlined. There are plenty of illustrations along with a complete set of specifications for each roller model. Available from Huber-Warco Co., Marion, Ohio, or check the reply card.

Complete Line of Road
Rollers and Compaction Equipment

520. Buffalo-Springfield's complete line of road rollers and compaction equipment is described in a 12-page illustrated Buletin No. S-73-157 just released by Buffalo-Springfield Roller Co., Division of Koehring Co., Springfield, Ohio. Check the reply card for on-the-job pictures, as well as construction details of the 2-axle tandems, 3-axle tandem, 3-wheel rollers and the K-45 Kompactor.

Agent For Improving Adhesion
Between Old and New Concrete

530. Thorobond liquid bonding agent for improving adhesion of new concrete to old concrete walls, floors and ceilings is described in literature available from Standard Dry Wall Products, Inc., New Eagle, Pa. Check the reply card for information on typical uses and methods of application.

Complete Line of
Asphalt Patching Mixers

586. Mixers capable of mixing 3 to 20 tons of hot mix per hour are described in literature available from McConnaughay Mixers, Inc., Lafayette, Ind. Check the reply card for full information on patching, repairing, resurfacing and sealing.

Catalog on John Deere
Tractors and Equipment

588. Information and specifications on the John Deere "420" crawler and wheel-type industrial tractors are fully covered in catalog from Deere & Co., 3300 River Drive, Moline, Ill. Attachments such as snow plow blades, rear-mounted blades, mowers and angling dozers are described. Check the reply card.

Choosing the Right Size
Tractor for the Job

655. An 8-page Bulletin D837 that explains how matched tools boost production by adjusting each tractor to the specific job is available from the Advertising Div., Caterpillar Tractor Co., Peoria, Ill. Also the methods for selecting used equipment are discussed. Check the reply card.

FROM THE MIDDLE ATLANTIC STATES

A dump truck operator reports

"I operate all over New York State," says owner-operator Wendell Wilbur, "and loaded or empty my Ford can beat any dump on the job."

Mr. Wilbur's big 1958 Ford T-850 has a 10-cu. yd. dump body, is powered by a 477-cubic inch V-8, grosses 50,000 lb. It is equipped with 5-speed main transmission, 3-speed auxiliary, and has a 156-inch wheelbase.

"I'm in this truck all day long," says Mr. Wilbur, "and it's the smoothest riding tenwheeler I've ever driven. And talk about handling!—with power steering my rig handles easier than a lot of pickups.

"This Ford's curb weight is almost 4,000 pounds less than other comparable trucks. That means more money-making payload for me."

Mr. Wilbur has been a truck user for more than twenty-five years, and he's been a Ford user just as long.

"My Ford T-850 has real power—on the hills I can pull away from any truck around—I even leave big diesels behind."

Wendell Wilbur
Owner-Operator
Ellenville, N.Y.

To order these helpful booklets check the reply card opposite page 38.

Construction Guide For Engineers and Builders

669. A 34-page four sectioned construction guide containing full-page structural drawings that provide basic information on types, grades and applications of fir plywood for engineers and builders has been released by Douglas Fir Plywood Association, Tacoma 2, Wash. Check the reply card for data on floor construction, single and double wall construction and roof construction.

Most Complete Line of Portable Rotary Compressors

698. The Ingersoll-Rand Gyro-Flo is available in 6 sizes—85, 125, 210, 315, 600 and 900 cfm. Write Ingersoll-Rand, 11 Broadway, New York 4, N. Y., or check the reply card for information on these advanced-design rotary compressors.

Slide Rule PS1 Calculator For Concrete

713. A new pocket size slide rule calculator for the testing of concrete in compression is available from Forney's Inc., P.O. Box 310, New Castle, Pa. It is designed to convert instantly the pressure applied to concrete cylinders and blocks into psi.

REFUSE COLLECTION AND DISPOSAL

How New, Larger Load-Packer Cuts Refuse Collection Costs

51. Ever increasing problems in refuse collection work include longer hauls and higher costs of labor, chassis, operation and maintenance. As a soluition, Gar Wood offers Load-Packers with dual-thrust compaction that gives big capacity on shorter wheelbase, plus safe, labor-saving operation. Profusely illustrated Form W-144 tells why you should investigate Load-Packers. Check reply card or write Gar Wood Industries, Inc., Wayne, Mich.

New Roto-Pac Features Speed Refuse Collection

50. Features of the Roto-Pac refuse collection unit, which include automatic continuous loading and packing, with increased power to provide for larger loads in the same size body, are described in bulletins issued by City Tank Corp., 53-09 97th Pl., Corona, L. I. Check the reply card now to learn how your collection problems can be eased.

Increasing the Efficiency of Bulk Rubbish Collection

177. Strategically spotted bulk containers can be handled by one man operating a Dempster-Dumpster equipped truck. Get full details of this cost-saving system of rubbish collection, as used by many cities to increase efficiency and eliminate unsanitary conditions. Write Dempster Brothers, Inc., 952 Dempster Bldg., Knoxville 17, Tenn., or use the handy reply card.

Refuse and Garbage Packer Bodies

241. Ranging in capacity from 12 to 24 cu. yds., the M-B packers have a 30 second compaction cycle and have large side loading doors. Write M-B Corp., New Holstein, Wisc., or check the reply card for bulletin on specifications.

Information on the Hydepak Refuse Packer

437. The Hydepak refuse packer is designed so that a lighter more economical truck body can be used and the packer is available in 13, 16, 20 and 24 yd. capacities. For complete specifications write Hydepak Division, Hobbs Trailers, 609 No. Main, Fort Worth, Tex., or check the reply card.

Data on Refuse Collection Bodies

615. The Hydro E-Z Pack compacting unit has only 2 working parts—a high volume roller bearing pump and a double-acting telescopic cylinder. A refuse-crushing compacting pressure of 82,500 lbs. is attained in the units. Write Hydro E-Z Pack Co., Galion, O., or check the reply card for complete specifications.

SNOW AND ICE CONTROL

Uniform Salt Spreading Saves Material

42. The wide, thin pattern provided by Tarco "Scotchman" spreaders avoids salt waste, saves time and labor. Get Folder BL for full details on their spreader and table of material application rates. Use reply card or write Tarrant Mfg. Co., Dept. PW, Saratoga Springs, N. Y.

Bare Pavement Maintenance With Sterling Rock Salt

84. Handbook is designed for road maintenance men who are responsible for safe winter pavements; and is a safe-roads fact book about a modern snow and ice removal program. Check the reply card or write International Salt Co., Inc., Scranton, Pa.

Sand and Cinder Spreaders For Streets and Highways

175. PTO with mechanical or hydraulic operation and auxiliary engine with mechanical or hydraulic operation are the choice of drives on these sand and cinder spreaders. Check the reply card or write Baughman Mfg. Co., 152 Shipman Road, Jerseyville, Ill., for complete catalog.

Full Line of Weapons for Snow and Ice Battles

268. Whether your snow problems are heavy or light, you'll find equipment for virtually all your needs among the plows and spreaders offered by Good Roads Machinery Corp., Minerva, Ohio. The "Champion Line" of Vee plows and one way and reversible plows with safety blade trip will handle snow removal: for chlorides and abrasives spreading there are five "Jet Line" spreader models and the 4-U towed spreader.

BAUGHMAN SAND and CINDER SPREADER

SAFETY CHAMPION FOR STREETS AND HIGHWAYS
choice of 4 drives

PTO with { Mechanical Operation / Hydraulic Operation

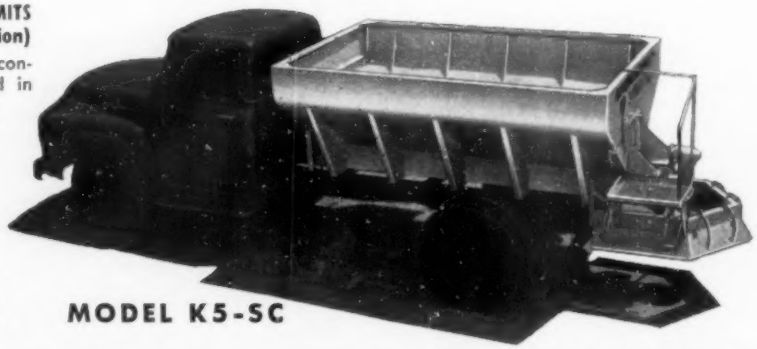
Auxiliary Engine with { Mechanical Operation / Hydraulic Operation

CAB CONTROLLED VACUUM CLUTCH PERMITS SPOT SPREADING (on mechanical operation)

Completely sealed, vacuum operation, controlled from cab. Start or stop spread in motion, as at intersections, safety zones. On hydraulic operation models, spot spreading is controlled by by-pass valve.

TWO-SPEED "QUICK CHANGE" MECHANISM

Simple sprocket and chain drive: low for chemical spreading, high for large-volume spreading. No need for expensive automotive transmission. On hydraulic opetation models, spreading volume is valve controlled.



MODEL K5-SC

Better service through better engineering

WRITE FOR NEW ICE CONTROL CATALOG!

Service and parts from 200 service branches

BAUGHMAN

BAUGHMAN MANUFACTURING COMPANY

156 SHIPMAN ROAD — JERSEYVILLE, ILL.

Reversible and Roll-Over Type
Snow Plows for any Depth of Snow

389. Village, city, county, state and airport officials send for the latest information on Frink's two catalogues on reversible trip-blade and roll-over snow plows. Complete assembly details, specifications and operation are completely outlined. Write to Frink Sno-Plows, Inc., Clayton, New York.

Catalog on Equipment
For Ice and Snow Control

410. Information on Baker snowplows and Flink ice control spreaders is available from The Flink Co, Dept. 5613, Streator, Illinois. Fully covered are reversible and one-way plows with hydraulic power lifts to meet every specification and single or dual spinner type spreaders. For reference catalog #110 check the reply card.

Sand, Chip and Calcium
Chloride Spreader For Ice Control

429. Complete specifications, performance records and prices on the Fox sand spreader are covered in literature from Fox River Tractor Co., Dept. R3, P. O. Box 469, Appleton, Wisc. Spreader can be attached or removed from most any dump truck in 15 minutes and can be operated from 5 to 40 miles per hour. Check the reply card.

Lift or Lower
Snow Plows Automatically

531. Battery operated or fan-belt driven hydraulic controls that lift or lower snow plows are described in literature from Monarch Road Machinery Co., 1331 Michigan St., N. E., Grand Rapids 3, Mich. Check the reply card.

Snow Plows For
Snow Control

539. V-type one-way and reversible plows with hydraulic hoist and having a plowing width of up to 9½ ft. are described in literature from Gledhill Road Machinery Co., Galion, Ohio. For models, specifications and features check the reply card.

STREET LIGHTING AND TRAFFIC CONTROL

Get Full Data
On the Radar Speed Meter

22. Accurate readings of vehicle speeds, with direct indications in miles per hour and a graphic recorder for permanent record are available by use of the Electro-Matic Radar speed meter, a product of Automatic Signal Division. Eastern Industries Inc., Norwalk, Conn.

Engineering Data on
Aluminum Lighting Standards

256. Latest designs and applications of all-aluminum, seamless, tapered lighting standards, and elliptical lighting brackets plus detail drawings and mechanical specifications are provided in a comprehensive 16-page bulletin issued by Pfaff & Kendall, 84 Foundry St., Newark, N. J.

Aluminum Lighting
Standard Catalog

768. This 16-page catalog contains complete engineering data and illustrations of the various types, sizes, weights and spans of lighting standards. Check the reply card or write Kerrigan Iron Works, Inc., Nashville 2, Tenn., for this valuable catalog.

RECREATION

Rubberized Playground
Surfacing Material

668. Saf-Pla can be applied to black top, concrete or properly surfaced areas to reduce injuries from children falling. Check the reply card or write to U. S. Rubber Reclaiming Co., Inc., Box 365, Buffalo 5, N. Y.

FROM THE SOUTHEAST

An over-the-road hauler reports

Estes Express Lines, of Richmond, Va., owns a 1958 Ford C-1000 Extra Heavy Duty Tilt Cab model. This rig is on the job 20 hours a day, piling up ten thousand miles a month.

Robey W. Estes, Vice President and General Manager, calls the performance he's getting from his new Ford Tilt "outstanding."

"The economy of Ford's 477-cubic inch V-8 compares very well with the 450-cubic inch sixes in our fleet," he adds. "The Ford performs better and doesn't use any more gas. We get over 5 miles per gallon, which is pretty good for our gross and our kind of hauling. The Ford also has a lot more power and speed. As one of the drivers told me—that Ford gets down the road mighty easy."

Estes Express's big Ford is a 1958 C-1000 tractor, with a 477-cubic inch V-8 engine. It has a 99-inch wheelbase, a five-speed transmission and a two-speed rear axle ratio of 6.14/8.36 to 1. Gross weight runs from 52 to 56,800 lb.

"Ford's Tilt Cab design gives us as much as 1800 pounds more payload than we could get with a conventional tractor. Drivers prefer the Tilt because of its comfort and maneuverability."

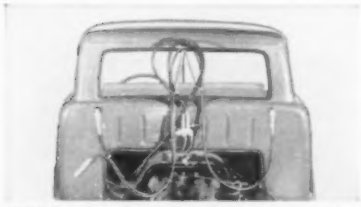
Robey W Estes

Vice President and General Manager
Estes Express Lines

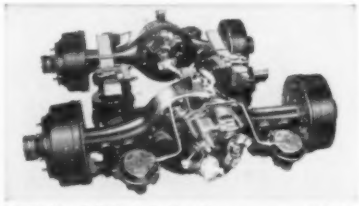
Whatever the job . . . wherever you do it!

There's more to look for in Ford's extra heavies for '59

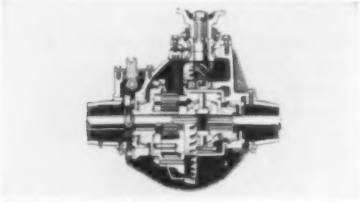
Ford Extra Heavies have proved themselves on every kind of job—you can count on them for *dependability* and *durability*. And in '59, you get high performance at low Ford prices for brand-new reasons! New faster rear axle ratios, new higher capacity axles, and other important options make big-truck operation still thriftier in '59 when you go *Ford*-ward. Send coupon for full information!



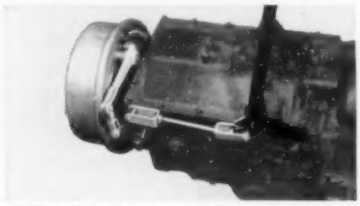
NEW Tractor Equipment Package provides complete trailer air brake and electrical connections, meets I.C.C. requirements.



NEW Ford Tilt Cab Tandems are available with three tandem-axle capacities: 28, 34, and 38,000 lb. Front axles to 15,000 lb.



NEW Faster Axle Ratios team up with Super Duty V-8's for greater gas economy and reduced engine wear. For example, 5.43/7.39 to 1 available in 1100 Series.



NEW 2-Shoe Brake (parking) is standard for '59 on all Ford Extra Heavies. Has 50% greater stopping and holding power, requires 50% less effort to operate.

Tilt Cab Tandem Ford C-950 (above) has hydraulic loader with push-button remote control.

Go FORD-WARD for savings FORD TRUCKS

FREE—COMPLETE FACTS ON NEW EXTRA HEAVY DUTY TRUCKS
Check Choice of Booklets and Return to:
FORD Division of FORD MOTOR COMPANY
P.O. Box 658, Dearborn, Michigan

☐ **Extra Heavy Duty Conventional and Tilt Cab Trucks**
Up to 36,000-lb. GVW, 65,000-lb. GCW

☐ **Tandem Axle Models**
Up to 51,000-lb. GVW, 75,000-lb. GCW

Name_____

Address_____

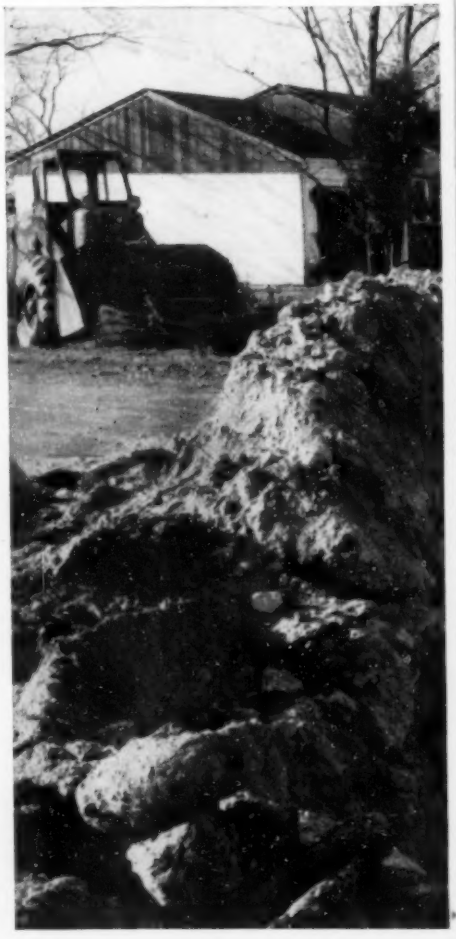
City_____ State_____

BRAND-NEW TILT CAB TANDEM FORDS for '59 combine the easier, more economical maintenance of tilts with high tandem-axle load capacities. Tilt design also permits higher front axle loads, longer body on given wheelbase. C-950 Tandem, above, operated by Fairlawn Supply and Concrete, Akron, has 15,000-lb. front axle, 34,000-lb. rear. Carries up to 6,500 brick, compared to 5,000 on a conventional tandem. Has 401-cu. in. V-8, 5-spd. main transmission, 3-spd. auxiliary, 201-in. wb. GCW (with pup trailer) 72,000 lb.

COST LESS ... *less to own ... less to run ... last longer, too!*

"Transite's installation recent increases

Says Philip J. Holton, Jr.
Chief Engineer
Water Supply Board
Providence, R.I.



"Our records show that labor and material costs have increased 100% since 1946. Yet, in this same period of time, our installation costs have increased only 21%. The ease of handling and speed with which contractors can lay Transite Pipe enable us to take full advantage of modern equipment and methods. In this way, Transite has played a prominent part in helping us offset increased costs."

Transite Pressure Pipe helps you cut system costs 3 ways: in design . . . installation . . . operation!

Today, in every part of the nation, municipal and consulting engineers choose Transite® Pressure Pipe. Ask why, and you find that economy is always among the Transite advantages they consider most important. For no pipe does so much to help keep your costs low in three different areas:

1. Design. Transite lets you plan a system for maximum efficiency. For its high carrying capacity (flow coefficient, C=140) often lets you specify pipe of smaller diameter. And because Transite's smooth interior remains smooth, you never need to make costly allowances for future reduction in carrying capacity.

2. Installation. Transite's installation speed cuts time and labor costs substantially. Light in weight for so durable a pipe, it handles easily above and below ground. And its Ring-Tite Coupling assembles quickly, surely . . . giving you a tight seal at every coupling in the system.

savings have helped us absorb in labor and material costs..."

Crews of Fanning and Doorley Construction Co. installing 8" line in Providence, R. I.

3. Operation. Here's where Transite really saves! For its maintained carrying capacity keeps pumping costs low year after year. Its strength, durability and corrosion resistance cut maintenance to a minimum, provide years of trouble-free service.

Transite's Ring-Tite Coupling cut away to show how rubber rings are compressed and locked in place to form a tight yet flexible joint.

We'll be pleased to send you booklet TR-160A. Write Johns-Manville, EN Box 14, N. Y. 16, N. Y.

"Good Water, the Lifeblood of your Community" Let's promote it—Let's have it!

JOHNS-MANVILLE

100 YEARS OF QUALITY PRODUCTS . . . 1858—1958

JOHNS-MANVILLE JM PRODUCTS

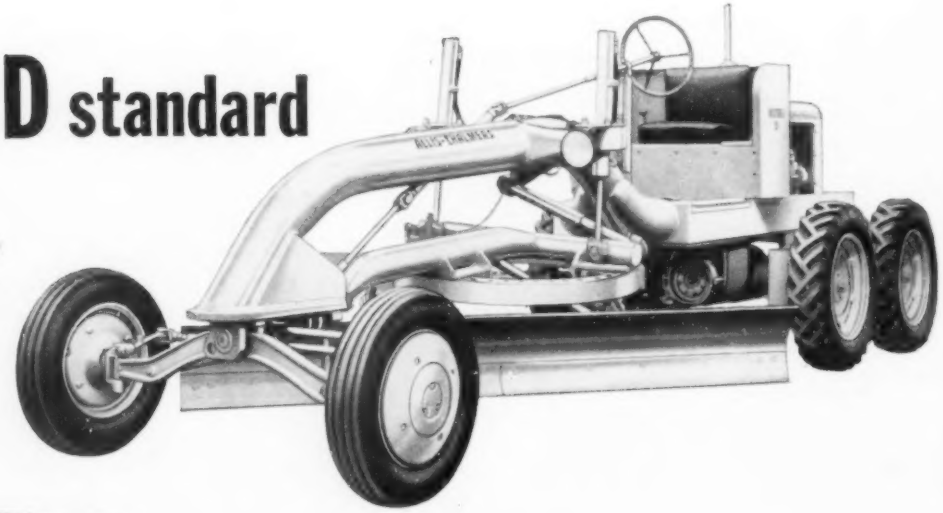
...for big economy on maintenance

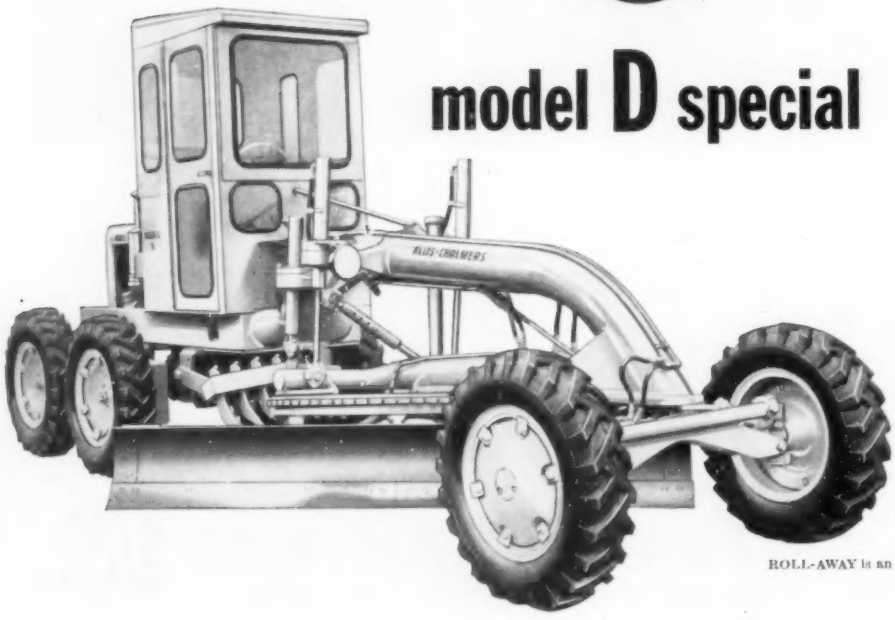
GET THE ALLIS-CHALMERS

Here's the original low-cost motor grader with big-grader design and performance advantages. The Model D handles so many jobs so well, you have to see it at work to convince yourself. Your Allis-Chalmers dealer can arrange a demonstration. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

model D standard

50 hp
Approx. weight
8,800 lb (gasoline)
Approx. weight
9,350 lb (diesel)





model D special

50 hp
Approx. weight
10,900 lb (gasoline)
Approx. weight
11,450 lb (diesel)
4 forward speeds to 25 mph (approx.)
1 reverse speed to 3 mph (approx.)
All-steel cab*
Shiftable moldboard*
Hydraulic scarifier*
Leaning front wheels*
Power circle turn*

*Also available with the model D standard as optional equipment.

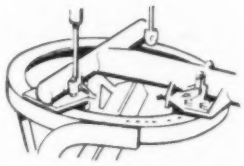
ROLL-AWAY is an Allis-Chalmers trademark.

and construction work

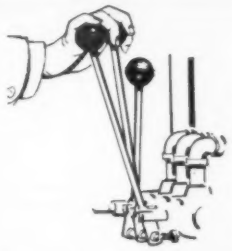
MODEL D MOTOR GRADER

many production-boosting advantages

The ROLL-AWAY moldboard rolls dirt up and ahead to eliminate packing, reducing friction . . . gives you more performance per horsepower, more production per gallon of fuel.



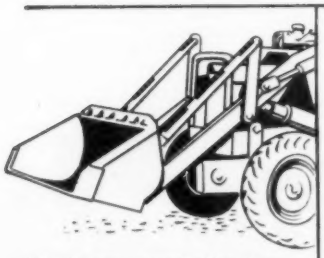
Revolving circle and heavy tubular drawbar provide exceptionally stable moldboard mounting.



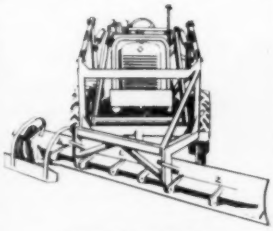
Convenient hydraulic controls, easy to operate. Two levers fit into one hand to control circle lift.

Positive tandem drive gives you four driving wheels under the heavy end of the grader.

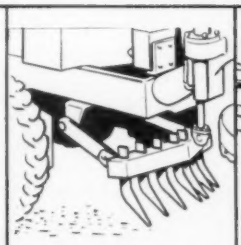
many job-multiplying attachments



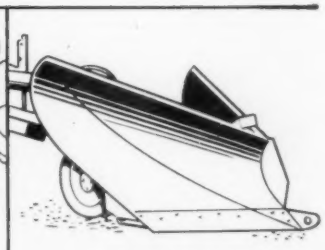
⅝-yd rear-mounted loader



Interchangeable shoulder maintainer



Midship-mounted scarifier



Blade and V-type snowplows

ALLIS-CHALMERS, CONSTRUCTION MACHINERY DIVISION, MILWAUKEE 1, WISCONSIN

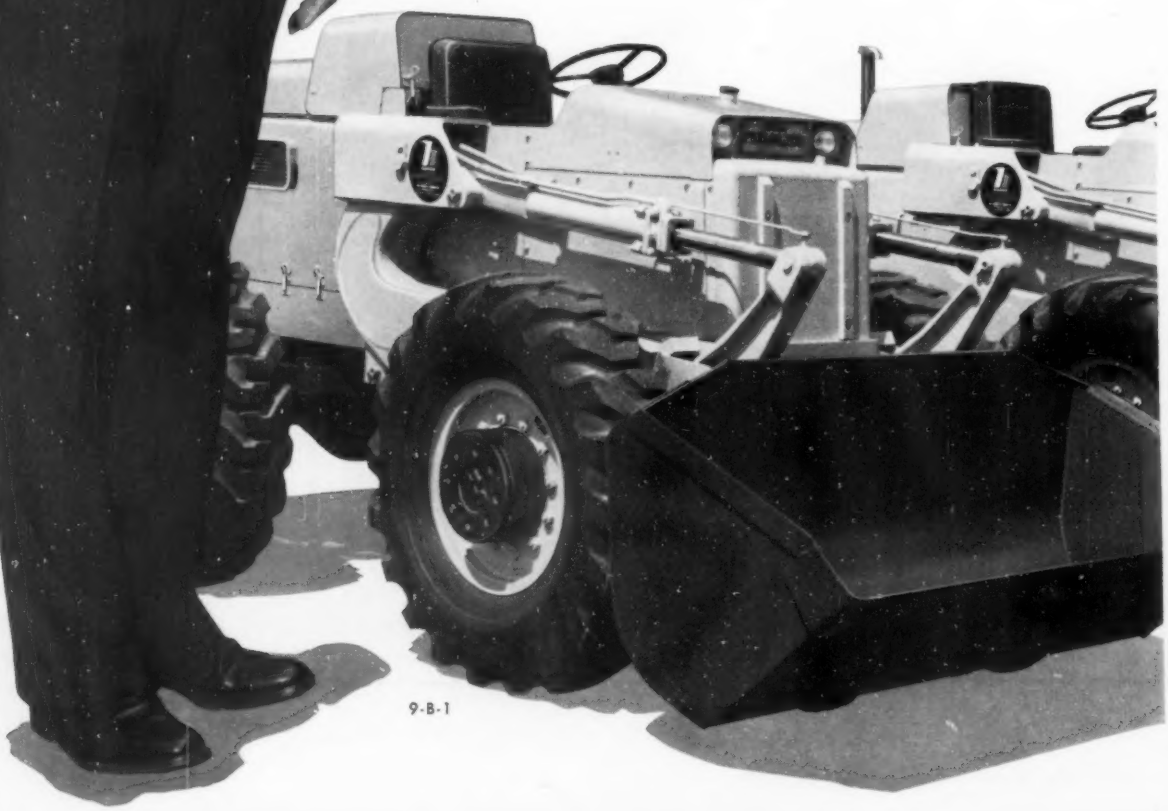
Look ahead... *move ahead*...and stay ahead

with ALLIS-CHALMERS

"These machines may look alike but there's **A BIG DIFFERENCE** *in their performance"*

"Our new model H-70 'PAYLOADER' may appear similar to its predecessor, the model HH, but that's where the comparison ends," says G. A. Gilbertson, President of The Frank G. Hough Co.

"Our program of continuous research and product betterment has made possible a number of improvements that make the model H-70 far superior in performance. These changes and what they mean in terms of improved tractor-shovel performance and satisfaction are pointed out in the following paragraphs."



9-B-1

Greater power

New and more powerful engines, both gasoline and diesel, give you reliable power and plenty of reserve power. Diesel engines are available in either 2 or 4 cycle types.

More traction

New, better weight distribution with 1500 pounds more weight on the rear wheels provides more useable traction at all times — gives more push for greater digging power, better climbing ability and surer footing on mud, snow and ice.

Stronger throughout

Many components have been made stronger than ever, including main frame, boom arms and bucket linkage. The new front axle assembly is 40% stronger and the rear (steering) axle assembly is 80% stronger. These axles are wider and increase the side stability of the model H-70. They also include larger main shafts and heavy duty planetary final drives in the wheel hubs.

Greater protection

To assure fullest protection of the engine when operating in dusty conditions, the H-70 uses a triple air cleaner system consisting of a precleaner and two oil-bath air cleaners. A cartridge-type oil filter is built into the hydraulic reservoir. Similar filters also protect the engine oil and the transmission-torque converter oil. The front service brakes are sealed to keep out dust and dirt.

Larger, more efficient torque-converter

The torque-converter in the model H-70 is larger with ample capacity for the job and closely matched to the engine and transmission characteristics. It is the efficient two-phase type with a high torque-multiplication factor (stall ratio) of 2.72 to 1.

"Paylomatic" power-shift transmission

The model H-70 has the same Hough-built "Paylomatic" full power-shift transmission that has demonstrated its superiority on the model HH. With 3 speeds in each direction, it provides low powerful digging speeds plus high forward and reverse travel speeds up to 26 mph. Finger-tip shifting up or down in either direction without "clutching" or stopping for a range shift, speeds operating cycles on any job.

Power-transfer differentials

The use of power-transfer differentials as standard equipment on both front and rear axle assemblies continues with this model H-70. These special differentials insure reliable traction on mud, ice and similar conditions by transferring more power to the drive wheels with the best footing when slippage is encountered.

What about rated capacity?

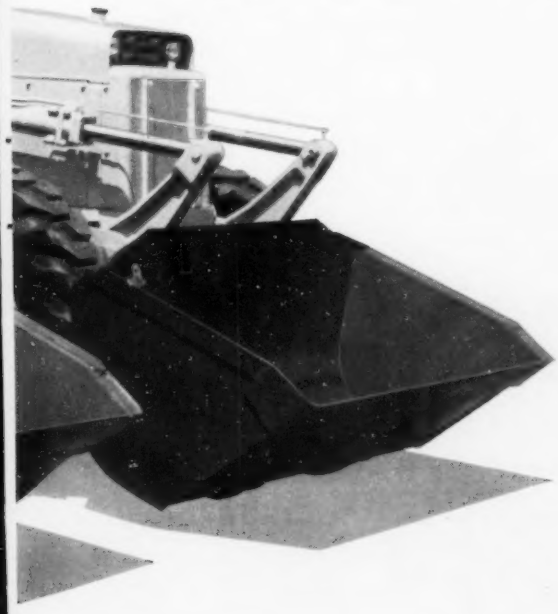
This model H-70 like all other "PAYLOADER" models is rated, not by "Bucket Size" or "Lifting Capacity", but by *Carry Capacity* — the pounds of material that can actually be carried in the bucket at speeds up to 4 miles per hour. The Carry Capacity of this "PAYLOADER" is 7,000 lbs. and you will note that the "70" in the model H-70 designation indicates it's 7,000 lb. Carry Capacity.

Knowing the Carry Capacity is 7,000 lb., you can select the bucket you need from the many sizes available (from 1 cu. yd. to 2¾ cu. yd.) depending on the specific weight of the heaviest material you want to handle.

For example, a 2 cu. yd. bucket for handling materials weighing up to 3,500 lbs. per cu. yd. (2 x 3,500 = 7,000 lb.). Insist on knowing the Carry Capacity of the tractor-shovel you buy. "Lifting Capacity" — what it will lift standing still — and "Bucket Capacity" are not enough.

Powerful pry-out bucket action

The model H-70 has the famous pry-out bucket action that distinguishes "PAYLOADER" units from all other tractor-shovels in both looks and performance. Your Hough Distributor would like you to prove to yourself that the model H-70 will out-produce any tractor-shovel near its size. Ask him for a demonstration, and you be the judge. The Frank G. Hough Co., 761 Sunnyside Ave., Libertyville, Ill.



Modern Materials Handling Equipment

THE FRANK G. HOUGH CO.

LIBERTYVILLE, ILLINOIS

SUBSIDIARY—INTERNATIONAL HARVESTER COMPANY

LEGAL ASPECTS OF PUBLIC WORKS

MELVIN NORD, Dr. Eng. Sci., LL.B.

The Case of the Smashed Lantern

City of Baltimore v. Locke, 140 Atl. (2d) 161, a Maryland case decided March 25, 1958, was an action for personal injuries sustained in a collision between plantiff Locke's automobile and an oncoming vehicle whose driver was then engaged in avoiding a hole in his traffic lane. The plaintiff recovered a judgment of $39,000 against the City in the trial court, and the City appealed.

The Bureau of Water Supply of Baltimore had made an opening in the street on Nov. 3, 1955, to repair a leak in the water main. It was about 6 feet in length across the center of the west-bound lanes and about 9 feet wide. On Nov. 5, the repair was completed, the hole "backfilled" in accordance with standard practice and the lanes opened to traffic. Permanent repairing cannot be done until the soil has been compacted by use, but inspections of the patch were made three times a day on Nov. 8, 9, and 10, and the patch showed no signs of depression or wear. It was 5 inches thick and laid over crushed stone.

At 12:30 A.M. on Nov. 12, a police officer on duty observed that the cold patch had settled to a depth of 8 inches, making a hole about a foot square in the center of the westbound lanes. He went to a point nearby, where a new street was being laid, and obtained a stringer 10 feet long and a cross-buck painted yellow, with danger signals on it, and a lighted red lantern. With these, he erected a barricade on the east side of the hole, placing the cross-buck about 5 feet north of the center lines, fitting the stringer into it extending to the north, and hanging the lantern on the cross-buck. He shook the lantern and it seemed to have enough oil in it to last out the night. He then called the Department of Highways and reported what he had done. His report was received by the clerk on duty, and a message was left on the superintendent's desk, who received it when he came to work at 7:30 A.M. A crew was then sent to repair the hole.

The police officer testified that he drove past the barricade several times during the night and observed the lantern burning, the last time being 4 A.M. The accident occurred at 6:20 A.M. Evidently the lantern had been smashed by a third person some time between 4 A.M. and 6:20 A.M.

The Court of Appeals of Maryland reversed the trial court's judgment, saying that the City could not be held negligent under these circumstances. It would have been impracticable to expect the City to do more before daylight, and they had no notice of the fact that a third person had smashed the lantern after 4 A.M. "Having performed its duty, in the first instance, the municipality is ordinarily not required to keep a man on guard to see that the barriers or lights are not removed."

Storm Sewer Discharge

Cooper v. City of Reading, 140 Atl. (2d) 792, a Pennsylvania case decided May 2, 1958, was an action for death by drowning in a pool formed by the discharge of waters from the outlet pipe of the City's storm sewer system.

In 1911 the City of Reading constructed a large outlet pipe, six feet in diameter, for carrying off storm water trapped by its storm sewer system in the southern part of the City. The City obtained an easement which permitted it to discharge the water from this outlet pipe into the Schuylkill Canal which, at that time, ran parallel to the east bank of the Schuylkill

HI-WAY
SALES & SERVICE
Nationwide

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Standard Machinery Company, San Francisco
COLORADO
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CONNECTICUT
Eastern Equipment Sales, Inc., West Haven
DELAWARE
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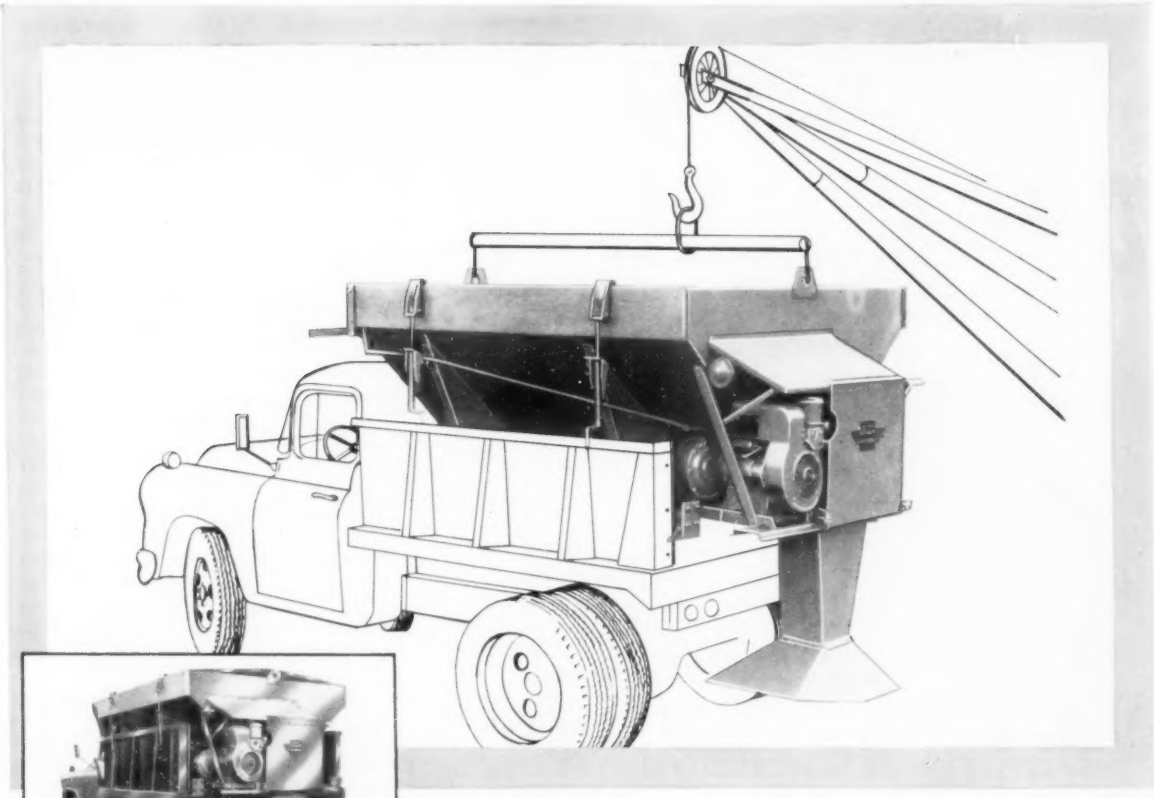
P-D Service, Inc., Pavilion, Buffalo
H. O. Penn Machinery Company, Inc., New York, Poughkeepsie, Westbury, Long Island
NORTH CAROLINA
H. B. Owsley & Son, Inc., Charlotte
NORTH DAKOTA
Northwestern Equipment, Inc., Fargo, Minot
OHIO
Rish Equipment Company, Cincinnati, Cleveland, Columbus, Dayton, Portsmouth, Toledo, Youngstown
OKLAHOMA
Leland Equipment Co., Tulsa, Oklahoma City
OREGON
Feenaughty Machinery Company, Portland
PENNSYLVANIA
Watson Equipment, Inc., Pittsburgh
Ransome Corporation, Philadelphia
SOUTH CAROLINA
Ray Long Equipment, Inc., Columbia
SOUTH DAKOTA Sioux Road, Inc., Sioux Falls
TENNESSEE
Tri-State Equipment Company, Memphis
Power Equipment Co., Chattanooga, Kingsport, Knoxville
TEXAS
J. W. Bartholow Machinery Company, Dallas
Conley-Lott Machinery Company, Lubbock
Equipment Supply Company, Inc., El Paso
UTAH
Rocky Mountain Machinery Co., Salt Lake City
VERMONT Mingolla Machinery Company, Barre
VIRGINIA
Rish Equipment Company, Richmond, Roanoke
WASHINGTON
The Carrington Company, Seattle
Feenaughty Machinery Co., Seattle, Spokane
WEST VIRGINIA
Rish Equipment Co., Bluefield, Charleston, Clarksburg, Parkersburg
WISCONSIN
Drott Tractor Company, Inc., Milwaukee, Madison, Rice Lake
WYOMING
Wortham Machinery Company, Cheyenne
HAWAII
Edward R. Bacon Co. of Hawaii, Ltd., Honolulu



Ready to spread, The HI-WAY CF Model displays its clean, compact design. Engine and all controls are compactly grouped for easy accessibility. Wooden rub boards protect the top of the hopper body from damage by front-end loaders.

From Storage To Spreading In 15 Minutes...HI-WAY Model CF!

- **Clamps to any dump body . . . use one rig with many trucks!**
- **Skid mounted, auger conveyor, 18 h.p. engine!**
- **One man can spread sand, salt, chips, calcium chloride!**

The HI-WAY Model CF Spreader can fill an important gap in your Equipment needs. It combines the extreme versatility, ease of installation and lower cost of tailgate-type spreaders with the heavy-duty performance and long life of truck mounted spreaders.

An 18 h.p., rear mounted, electric starting engine with built-in clutch reduction, powers models with up to 6¼ yd. capacities. Optional cab-controls allow driver to handle starting, throttle, clutch and 8′ to 32′ width of spread off the big 18″ spinner.

There's a HI-WAY Spreader to Fit Every Specification

Model E, Truck Mounted—Choice of drives; PTO, motor-driven with or without hydraulic. Spreads all types of materials at any season.

Model J—Tailgate Spreader is geared to the surface of the road. Spreads in echelon or blanket patterns to 9 ft. widths.

Look on the adjoining page for the distributor nearest you.

HIGHWAY EQUIPMENT COMPANY
605 D. Ave. N. W. Cedar Rapids, Iowa

NEW from ORANGEBURG

A SUPERIOR 75-POUND PLASTIC PIPE

No pinholing — It's completely slit-proof!

75-pound Orangeburg SP Plastic Pipe—like Heavy-Duty Orangeburg SP Plastic Pipe—is made from a superior new-type resin. Its molecular weight—which governs toughness and strength—is at least 30 times higher than other types.

To you, this means performance you can rely on to do a better job. 75-Pound Orangeburg SP is approved for drinking water service by the National Sanitation Foundation. It is ideally suited for water systems, water lines from street main to house, and other water services outside the home.

75-Pound Orangeburg SP also is ideal for water lines serving city parks, play centers, golf courses, swimming pools, sprinkler systems, etc.

Only 75-Pound and Heavy-Duty Orangeburg SP Plastic Pipe offer the advantages of this new slit-proof, pinhole-proof, high-molecular weight resin. Its quality is backed by Orangeburg, a great name in pipe for over 65 years.

For facts, write Dept. PW-108.

APPROVED FOR DRINKING WATER SERVICE BY NATIONAL SANITATION FOUNDATION

Competitively Priced

ORANGEBURG® SP Plastic Pipe

Orangeburg SP Plastic Pipe is spirally wrapped in heavy kraft paper for convenient handling, clearly labeled and provided with a convenient rip cord for easy removal of wrapping. Sizes from ½" to 2" in standard coil lengths.

ORANGEBURG MANUFACTURING CO., INC., Orangeburg, N.Y. ... Newark, Calif.

River in the City. The canal was then in general use as a navigable waterway and the waters discharged from the pipe were carried off as part of its flow. In 1931, the use of the canal as a waterway was discontinued; it became largely dried up and was filled in with earth in places.

The City of Reading continued to discharge its storm drainage water into the bed of the former canal through the pipe it had originally constructed. Over a period of years the water formed a pool at the pipe outlet, about 5 feet long and 41 feet wide. The pool is shallow at the edges, but near the center the constant flow of water from the City's outlet pipe has eroded the former canal bed and caused the formation of a hole 16 feet deep. The pool was used by children in the summer for swimming and for sliding on the ice during the winter. No attempt was made to block the approach to the pool, despite the fact that a child had drowned three years prior to the present case.

The accident occurred during the winter, when several boys were playing on the ice. The ice broke, several boys fell in and two Cooper boys were drowned.

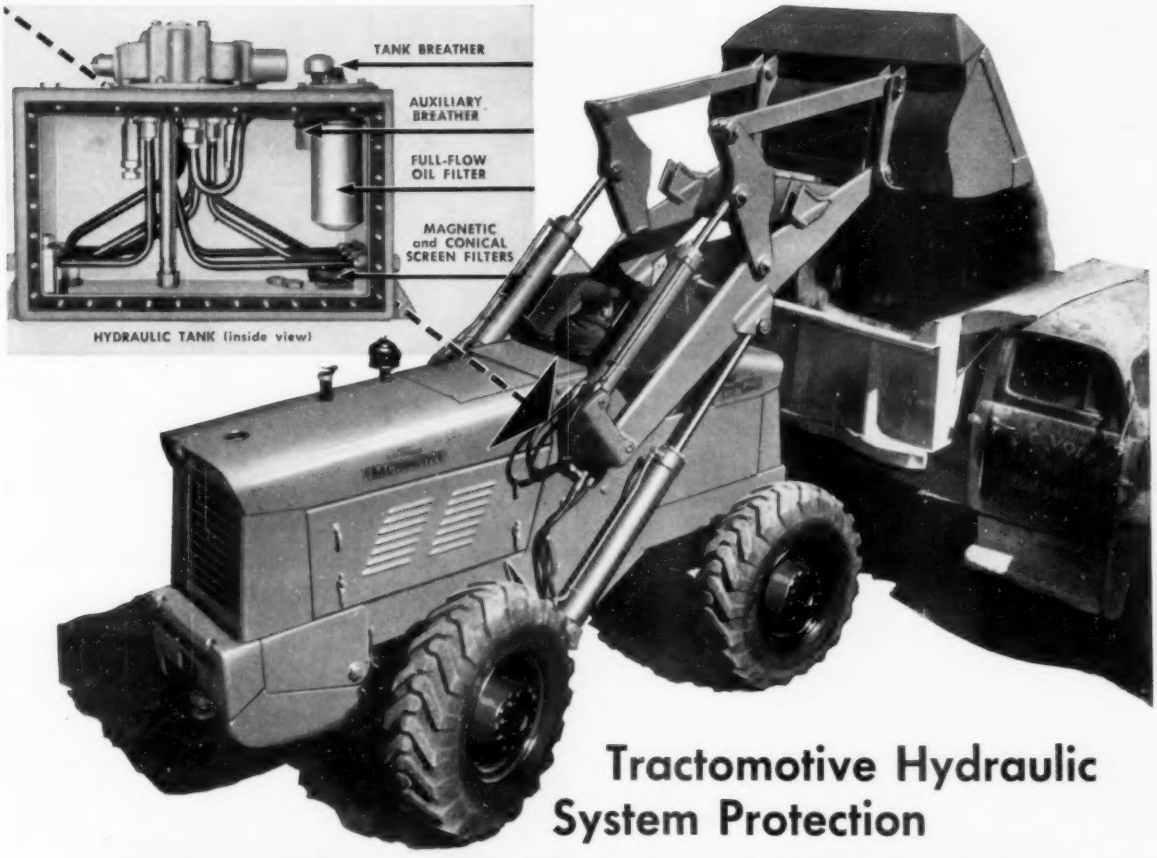
The jury gave a verdict totalling $15,000. The City appealed on the ground that it did not own the land on which the pool existed and could therefore not be liable under the *attractive nuisance* doctrine, and further, that it also could not be held liable for *negligence* because of its governmental immunity.

The appellate court held to the contrary on each of these defenses. The City had an easement and controlled the use of the land on which the pool was located. Therefore, it was subject to the attractive nuisance doctrine. Secondly, the City did not create the pool in pursuance of its storm drainage project (which would be a governmental activity), but passively allowed the water after it had disposed of it, to form into a pool on land under its control. *This* was not a governmental activity, and carried no immunity.

• • •

North Carolina Secondary Road Maintenance

For maintenance of the 58,000-mile secondary road network, North Carolina has earmarked $60 million for the forthcoming biennium. In addition, $27 million is allotted for improvements to county roads and bridges. About 24,000 miles of these secondary roads are unpaved.



Tractomotive Hydraulic System Protection

CUTS DOWNTIME

Another exclusive feature on this Big TL-20 TRACTOLOADER®! Another example of Tractomotive Common Sense Design!

Trouble is kept *out* of the TL-20 hydraulic system. Air is double-filtered — by an outside and an inside filter. All hydraulic oil is thoroughly and constantly cleaned by a full-flow oil filter. Metallic and other particles are caught by a magnetic filter and a conical screen filter. What other hydraulic system gives you such *complete protection?* And what a difference this makes in loader performance . . . in loader upkeep . . . in less downtime, more working time.

Here is another TL-20 exclusive . . . another Tractomotive design difference that means a profit difference!

There is a fast-working TRACTOLOADER to fit every job — 15 cu ft to 2 cu yd . . . 2 and 4-wheel drive.

TRACTO — *a sure sign of modern design*

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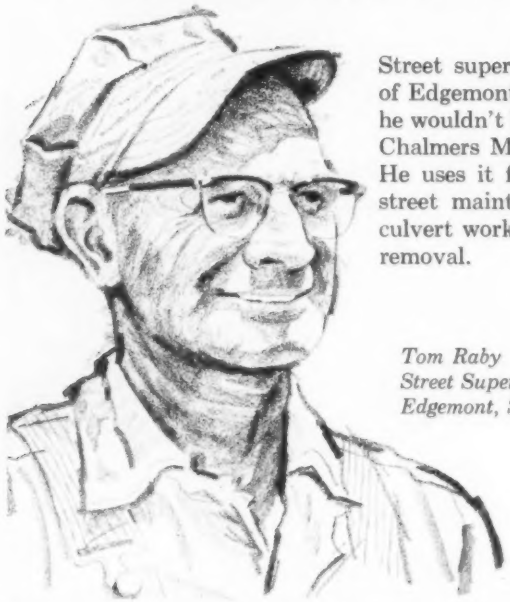
He's stretching tax dollars

...with an Allis-Chalmers Motor Grader



Street superintendent Tom Raby of Edgemont, South Dakota, says he wouldn't be without their Allis-Chalmers Model D motor grader. He uses it for low-cost road and street maintenance, ditching and culvert work, scarifying and snow removal.

Tom Raby
Street Superintendent
Edgemont, South Dakota

Shown working on the edge of town, Edgemont's Model D is equipped with optional power circle turn and leaning front wheels. Big-grader features like these give greater operating ease, greater work range.

Low-cost Model D maintains up to 15 miles of road per day

Edgemont tax dollars went a long way when they were used for an Allis-Chalmers Model D motor grader. Costing only one-third the price of a large machine, the "D" handles all community grading jobs. It works miles of streets and roads in the area and is also used for ditching to put in new culverts and water mains. Edgemont's Model D has maintained over 31 miles of road in two days—does it three times a month in wet weather.

Versatility combines with economical operation

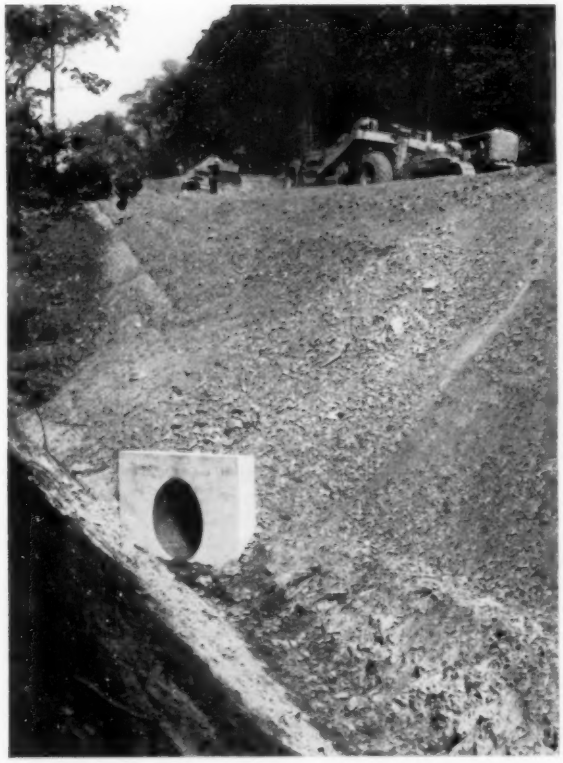
The "D" is also used effectively on spot assignments. A hydraulic scarifier equips it for ripping old oil surface roads and digging into old culverts. In winter, the "D" scarifies frozen ground on light construction jobs and helps keep snow removal under control with its blade. And for good measure, it maintains the city dump.

Superintendent Raby says his compact Model D does things a big machine can't do—close-quarter grading, easy turning and working around culverts. It has plenty of power, and yet Edgemont gets considerable savings in operating costs. He reports the "D" uses only seven gallons of fuel in eight hours of work.

Ask your Allis-Chalmers construction machinery dealer to show you a "D" in action—50-hp gasoline engine, 8,800 lb. or 50-hp diesel engine, 9,350 lb. You'll like what you see—whether it's grading, maintaining, ripping, loading, removing snow or handling many other applications with attachments including ripper, V-type snowplow, ⅝-cu-yd loader, shoulder maintainer. Allis-Chalmers, Construction Machinery Division, Milwaukee 1, Wisconsin.

Look ahead... *move ahead* ...and stay ahead with **ALLIS-CHALMERS**

For shallow fill or deep Beth-Cu-Loy pipe flexes with the load



Because galvanized corrugated Beth-Cu-Loy pipe is made of steel sheets, it is not only strong, but flexible. So whether the fill is shallow or deep, a Beth-Cu-Loy pipe has the unique ability to "give" with the fill and transmit the load around its entire periphery.

Rigid pipe cannot flex with the load, and thus is unable to transfer any appreciable portion of the load to the surrounding material. The bulk of the pressure is exerted through the vertical axis of the pipe. That's why many states actually specify the use of sheet metal pipe such as Beth-Cu-Loy under fills of less than 2 ft or more than 15 ft.

Flexibility, of course, is only one advantage of galvanized Beth-Cu-Loy culvert drainage pipe. The zinc coating (2 oz triple spot test) provides long resistance to corrosion. The pipe's light weight permits easy handling and quick installation of long pipe lengths, and reduces shipping costs. Field joints can be made in minutes, with no time out for setting or curing.

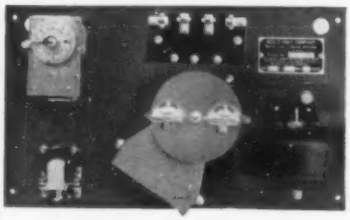
Bethlehem does not manufacture culvert pipe, but does supply Beth-Cu-Loy (copper-bearing steel) sheets to pipe fabricators. If you would like further information about Beth-Cu-Loy, or the pipe made from it, ask your fabricator for a copy of Bethlehem Booklet 425-A.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA. On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation

BETHLEHEM STEEL

BETHLEHEM STEEL

RPS ROTO-TROL



Pressure Operated Sump Control with Purged Air System

Furnished with compression bell for wet well. Pressure differential regulator with meter that regulates and indicates rate of air flow. Furnished with air compressor, or can be operated from plant air supply.

Write for New Bulletin RPS

WATER LEVEL CONTROLS DIVISION

HEALY-RUFF Company

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TRACTOR SHOVELS
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Municipal Power

BRUCE J. ENNIS

Principal Engineer, Burns & McDonnell Engineering Company
Kansas City, Missouri

Do You Know What You Have?

THERE ARE approximately one thousand municipal systems in the United States charged with the responsibility for providing adequate, dependable and economic electric power service to the residents, the stores and shops, and the factories of their communities. These range in size from the half-billion dollar property of the City of Los Angeles, with its huge power plants and its thousands of miles of transmission and distribution lines, to the remote village serving a few hundred consumers over a few miles of distribution circuits.

At the utilization level, where a pound of coal, a gallon of oil, a few cubic feet of gas or a falling column of water is converted by modern technology to light a home or spin the wheels of a factory, there is no distinction regarding the size of the electric system which supplies the energy for a service so essential and so basic to the needs of modern civilization. A kilowatt hour of electricity is as vital to a share-cropper in Mississippi as it is to the owner of a spinning mill in Massachusetts.

The responsibility for providing these kilowatt hours, at the lowest cost commensurate with an adequate and reliable supply of energy, is of equal importance to the municipal official of the smallest as well as of the largest system. The mayor, the city council, the board of public utilities, the power plant superintendent, the lineman and the meter reader all contribute to the multilateral business of supplying electric service to their cities, towns or villages.

The extent and scope of this business varies, of course, among the municipal systems throughout the country; however, there are certain fundamental problems common to all. These are: The generation or purchase of power; the transmission and distribution of energy; the operation and maintenance of the physical properties; the design, construction and financing of system improvements and extensions; and the management of the business of the electric utility. It is in the optimum solution of these problems, of varing degree and complexity, that the opportunity exists for continual improvement in the supply of electric service to the community.

There are two basic steps in the solution of these problems for the possible improvement of system operations. These are:

1. Self-analysis of the individual system, to determine physical improvements necessary in the generation, transmission, distribution and general plant facilities.
2. Comparison of system operations with those of other systems of similar scope and character, to determine possible areas for improvement and betterment in the operation and maintenance of the properties and in the management of the business of the utility.

In order to plan technical improvements for system additions and extensions, and to achieve maximum efficiency in system operations in an intelligent and logical manner, it is fundamentally necessary to bring up to date and perpetuate an inventory of all the system's physical properties including power plants, transmission and distribution lines, substations, and general plant facilities. It is equally important to keep financial records and operating statistics on a monthly as well as on an annual basis.

Such records provide a basis for the determination of depreciation reserves for the utility plant as a safeguard against "coming up short" when a major piece of equipment fails in service or has to be replaced. They are essential to the preparation of a prospectus for a general obligation or revenue bond issue to finance system additions and improvements. In addition, the analysis of system records of past

Here are 4 reasons why you will want your own personal copy of the new American Concrete Lighting Standard Catalog No. 400

- **LATEST DESIGNS FOR HIGHWAY LIGHTING**
- **MODERN FLUORESCENT LIGHTING INFORMATION**
- **NEW BRACKET AND BASE DETAILS**
- **INTRODUCING THE 800 SERIES STANDARD**...with continuous through-the-ground-line taper, requiring no bolting or concrete foundationing ...saves time and money.

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American Concrete

PRESTRESSED CONCRETE LIGHTING STANDARDS

85 cfm GYRO-FLO Compressor

The capacity, weight, size and the POWER you want for municipal maintenance

Yes, this is *it!* The smallest, lightest weight portable rotary air compressor ever developed. The ideal air power plant for hundreds of municipal maintenance jobs like the one shown above.

This 85 cfm rotary compressor, smallest member of the famous Ingersoll-Rand Gyro-Flo line, has ample power to operate a multitude of the small air operated rock drills and pneumatic tools that are used so frequently on municipal maintenance jobs. It weighs only 1724 lb. complete with running gear, and 1469 lb. stripped for truck mounting.

Like all Gyro-Flo units, it gives you *smooth, dependable* air power. And its maintenance cost is so low you'll hardly believe it. Other Gyro-Flo compressors are available in sizes to 900 cfm.

Ask your Dealer or I-R Representative for complete information. Or write for Bulletin 2307.

Ingersoll-Rand

2-834 11 Broadway, New York 4, N. Y.

AN UNBEATABLE COMBINATION . . . GYRO-FLO COMPRESSORS AND I-R ROCK DRILLS

operations presents an invaluable guide for the determination of necessary or desired changes in the operation and maintenance of the physical properties, and in the management of the utility business.

Obviously, the keeping of such records for an electric utility, large or small, presents a considerable problem in accounting and bookkeeping. Fortunately, a very logical and comprehensive procedure for the maintenance of such records has been developed by the Federal Power Commission. This ready reference manual, which should be in the management office of all municipal electric utilities, regardless of size, is the "Uniform System of Accounts Prescribed for Public Utilities and Licensees." It is nominally priced and is for sale by the Federal Power Commission, Washington 25, D. C. This system of electric utility accounts has been divided into several major categories, whose purposes are as follows:

Balance Sheet Accounts: To show the financial condition as of a given date, including assets, liabilities, surplus, etc.

Electric Plant Accounts: To record organizational expense and the investment in physical properties, including intangible, production, transmission, distribution, and general plant facilities.

Earned Surplus Accounts: To show the amount of earned surplus funds at the beginning and end of a given period. In general, this represents the utility's net equity in the ownership of the system, acquired from earnings.

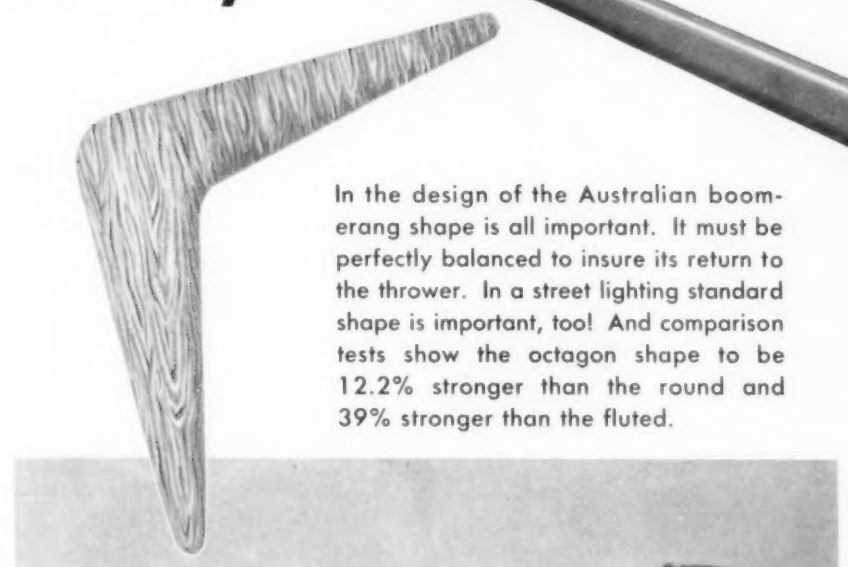
Income Accounts: To show operating revenues and expenses, other income, income deductions, depreciation, amortization, taxes, and miscellaneous reservations of net income, including the amount of income or loss for transfer to earned surplus.

Operating Revenue Accounts: To record the revenue resulting from the sales of electric energy and other electric revenues earned from system operations.

Operating Expense Accounts: To show in detail all costs for furnishing electric utility service (except depreciation, amortization, property losses, and taxes). These accounts include operation, maintenance and miscellaneous expenses and are broken down under the subdivisions of production, transmission, distribution, customer's accounting and collecting, sales promotion, and administrative and general expenses.

Clearing Accounts: To show the expense of storage handling, dis-

Shape IS IMPORTANT TO **BOTH!**



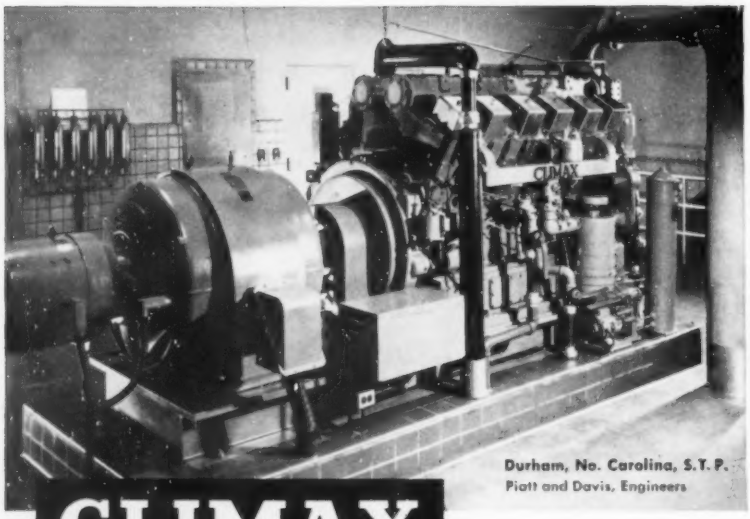
In the design of the Australian boomerang shape is all important. It must be perfectly balanced to insure its return to the thrower. In a street lighting standard shape is important, too! And comparison tests show the octagon shape to be 12.2% stronger than the round and 39% stronger than the fluted.

Kerrigan Weldforged Standards line new streets in the Capitol Hill Redevelopment Project in Nashville, Tenn.

Approved by leading architects, engineers, contractors and City, County, State and Federal officials, Kerrigan octagon shaped lighting standards are now installed in over 170 cities and towns.

Our new catalogs on steel and aluminum standards tell about the comparison tests and other features you will like. We'll be glad to send them free. Just drop us a line. Address: Dep't. P-10.

KERRIGAN
IRON WORKS, Inc.
NASHVILLE, TENNESSEE

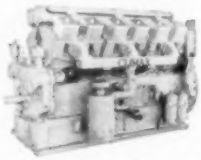


Durham, No. Carolina, S.T.P.
Platt and Davis, Engineers

CLIMAX
POWER
FOR SEWAGE TREATMENT PLANTS...

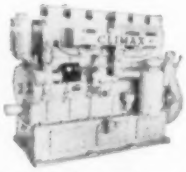
Climax engines can be found on the job every day of the year in hundreds of sewage treatment plants from coast to coast—powering sewage pumps, blowers and generators. Tremendous savings are being realized by using readily available **sludge gas** for fuel and also by utilizing heat from the jacket water and exhaust gas of the engines to heat digesters and buildings. When a shortage of sludge gas is encountered these engines operate on an auxiliary fuel—either gasoline, butane or natural gas, or a combination thereof. Eight Climax engines are available for continuous duty service in Sewage Plants in a range of sizes from 40 to 300 hp.—for standby service up to 605 hp. max. rating.

Write today for complete information, bulletins or engineering consultation.

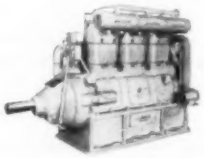


V-125—12 cylinder, 605 max. H.P. at 1200 R.P.M.
V-122—12 cylinder, 520 max. H.P. at 1200 R.P.M.

V-85—8 cylinder, 390 max. H.P. at 1200 R.P.M.
V-80—8 cylinder, 340 max. H.P. at 1200 R.P.M.



K-75—6 cylinder, 302 max. H.P. at 1200 R.P.M.
K-67—6 cylinder, 265 max. H.P. at 1200 R.P.M.



R-165—6 cylinder, 192 max. H.P. at 1200 R.P.M.

CLIMAX ENGINE MANUFACTURING CO.
DIVISION OF WAUKESHA MOTOR COMPANY
FACTORY — CLINTON, IOWA

tribution of materials and supplies, adjustments of inventories, and associated and miscellaneous expenses.

The "Uniform System of Accounts" contains definitions of terminology common to utility operations as well as instructions for the proper classification of plant equipment, revenue accounts, operating expense accounts and other items. Each account has been assigned a specific number, which is common to all properties or funds of a similar nature in all electric utilities throughout the country. The items comprising each account, and subdivisions thereof, are described in detail in the instructions, making it a relatively simple matter to assign the value of the property and of the funds of a given utility to the proper balance sheet account.

Once the total property investment of a given utility has been broken down into the various classifications and subdivisions of electric plant accounts, it is possible to maintain a straightforward inventory of all plant additions and retirements, and, literally, "to know what you have."

In addition to the foregoing bookkeeping procedure for plant property and assets, the "Uniform System of Accounts" provides a guide for the logical classification and assignment under various categories of operating funds and expenses. In each of these categories, instructions are presented in such detail that it is possible, for example, to assign precisely the value of a postage stamp used in collecting a consumer's bill, to a definite account.

By cataloging in such a manner the total income and expenses pertaining to the operation and maintenance of a given system, and to the management of its business, it is possible to know at all times where the utility stands, and to correct incipient deviations from a desired normal trend.

The keeping of such property and operating records has been standard procedure for many years with the larger municipal power systems. Such records, even if in an abbreviated form, should be kept by all utilities, no matter how small. The time spent in assembling and cataloging such data will be repaid many times over in the increased efficiency in the operation of the system.

Editor's Note: In subsequent issues Mr. Ennis will discuss other aspects of municipal power systems, including engineering, maintenance, administration and financing.

LTG-30
P & K outdoor packaged lighting units make the job easier
a universal outdoor lighting fixture
for post-top or slip-fitter side mount
this 8 page booklet tells you what you want to know
CIRCLElux luminaire
IN THIS CATALOG
PAGE
the CIRCLElux 2
electrical characteristics 3
post-top mount . . specifications and photometric data 4 & 5
slip-fitter side mount . . specifications and photometric data 6 & 7
delivery service 8

MORE FACTS ABOUT "PACKAGED" OUTDOOR LIGHTING

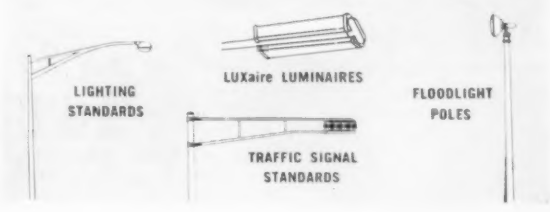
Having created a new concept in outdoor lighting with the development of "packaged" units P & K now brings a wealth of new information to the field. Basically, a "packaged" unit is one in which both standard and lighting unit are supplied together by the same manufacturer. The advantages are obvious: simplification of ordering and specifying, reduced shipping and handling costs, ease of assembly and installation. What's most important, however, is the fact that these handsome all-aluminum standards are available in straight and davit styles, in a wide range of sizes, and can be obtained with a choice of three light sources—incandescent, fluorescent or mercury vapor. In this way it is possible to customize any installation with standard units assembled to your specifications.

Now, in this helpful booklet P & K has provided all the facts you want on CIRCLElux units—catalog numbers, lighting curves, electrical characteristics, etc. Write for your copy of LTG-30 today.

P&K

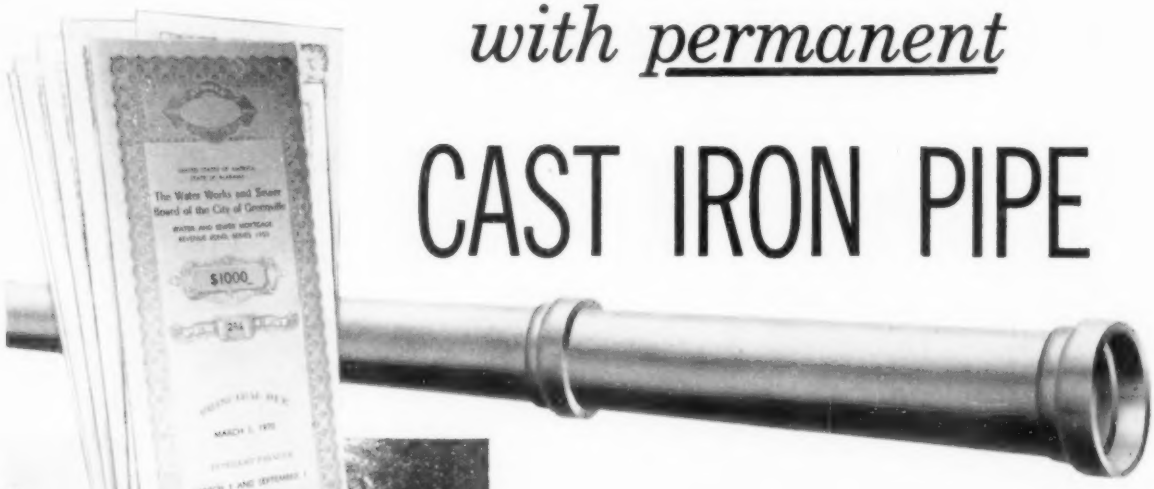
PFAFF & KENDALL

84 FOUNDRY STREET, NEWARK 5, N. J.



Underwrite Your Bonds for Water Works Improvements with permanent

CAST IRON PIPE



It's important to your city — and investors who buy your bonds for new water works projects — that the life of these improvements should be longer than the debt. This is why large buyers of bonds request an engineer's report with the bond prospectus. They seek assurance that the pipe which will be used in new water works construction will not need replacement or costly repairs before the bonds mature.

No other pipe has ever matched the trouble-free service record or longevity of Cast Iron Pipe. Forty-two North American cities are still using cast iron water mains laid a century or more ago. Hundreds more have passed the 50-year mark. When your community extends or improves its water system, specify Cast Iron Pipe, which has long been known as

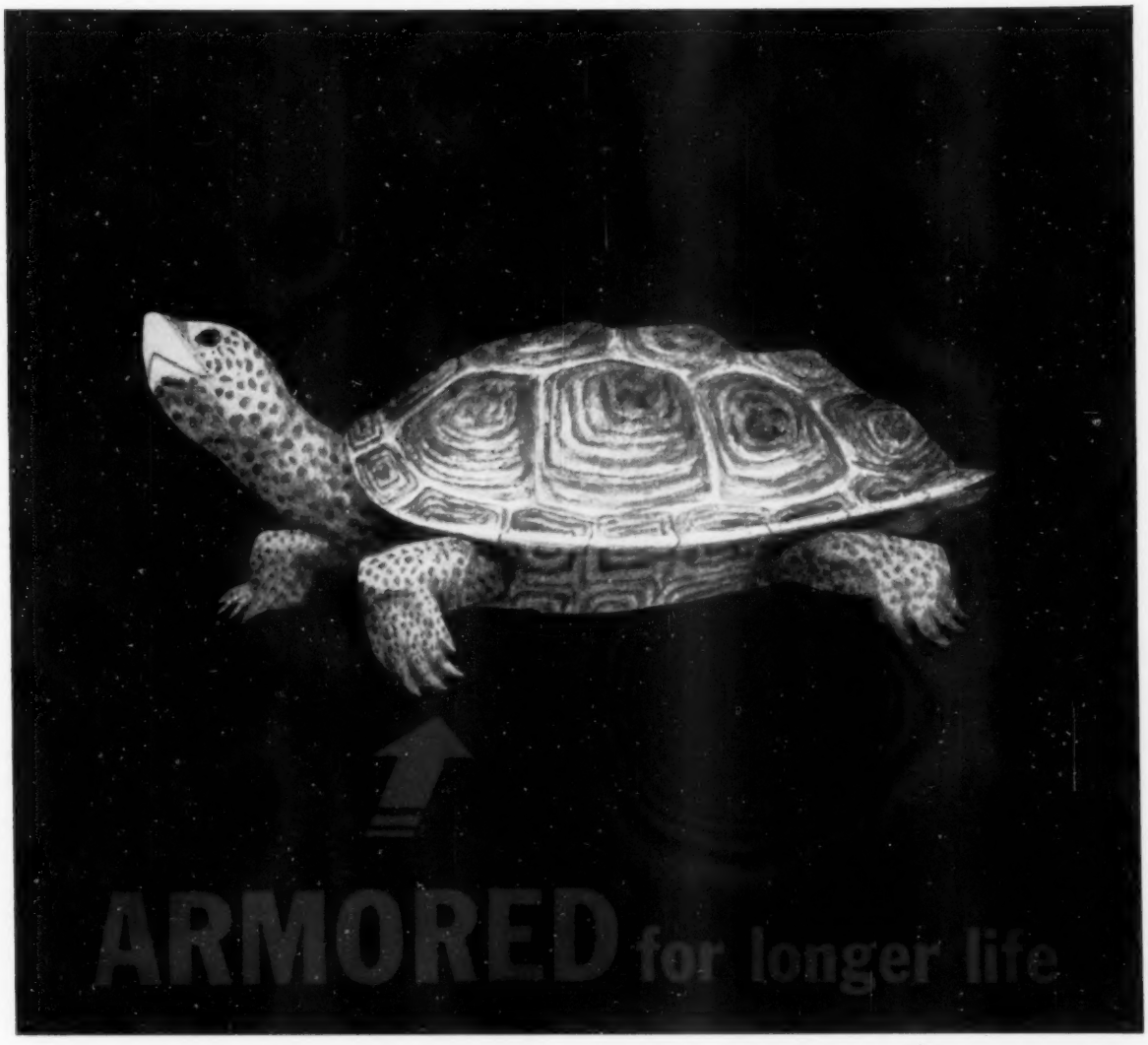
"America's No. 1 Tax Saver."

Our Company does not manufacture Cast Iron Pipe but supplies many of the nation's leading foundries with quality pig iron from which quality pipe is made.

WOODWARD IRON COMPANY

Since 1882

WOODWARD, ALABAMA



Simpson Overlaid Plywoods bring to signs the same protection that is afforded the tortoise by his shell. The finest sign material ever developed, Overlaid Plywood is as workable as ordinary plywood . . . gives better results than metal. Signs made with this material will not crack, chip nor shatter. They cannot be wrapped around their posts by vandals and bullet holes almost seem to seal themselves. Your signs will live *years* longer on Simpson Overlaid Plywood.

HIGH DENSITY: Is available in black for direct application of reflective material (needs no painting) or smooth, natural finish, ready for painting.

MEDIUM DENSITY: Is especially fine for painting, having been developed for this purpose. No finer surface for painted bulletins, billboards and cut out "spectaculars."

◀ *State after state is standardizing on Overlaid Plywood signs.*

RELY ON Simpson PLYWOOD

For information and samples, write to:

Simpson Logging Company, Plywood & Door Products, 2301 N. Columbia Boulevard, Room 1102-K, Portland 17, Oregon: Regional Offices in New York, Cleveland, Minneapolis, Chicago, Denver, Memphis, Dallas, Los Angeles, Seattle, and Portland.

FD-86

Overhead signs of "Scotchlite" Reflective Sheeting and "3M Signal" Letters help keep 24,000 vehicles per day moving smoothly along First Avenue in Cedar Rapids, Iowa.

High traffic-sign standards and an efficient sign-replacement program result in

Improved Traffic-Flow for Cedar Rapids

Robert M. L. Johnson
Commissioner of Public Safety
Cedar Rapids, Iowa

Progressive Cedar Rapids (population, 80,000), under the leadership of Mayor Meaghan and Safety Commissioner Johnson, last year installed 1,412 new traffic signs. The first half of 1958, the city gained by 835 new signs. In the same period, 2,091 signs were refurbished. Purpose: To raise traffic-control standards to modern levels, improving traffic flow and safety. Result: Success.

Through this complete renovation program, the standard of Cedar Rapids has been to reflectorize signs with prepared faces of "Scotchlite" Reflective Sheeting. This versatile material not only provides 24-hour-a-day visibility to all signs, but economy and efficiency of sign shop production as well. Pavement markings also have been reflectorized. And Cedar Rapids traffic now moves more smoothly, more safely than ever before. Could these standards help your city? Ask Cedar Rapids. Or your 3M Representative. Or, if you prefer, write 3M Company, Dept. QV-108, St. Paul 6, Minn., for details.

Durable "Conterlite" Reflective Compound gives 24-hour-a-day visibility to symbols and striping on the pavement. Note large arrows and solid lane stripes to help guide motorists safely, surely.

Commissioner Johnson and Mayor James J. Meaghan inspect new reflective street-name sign, one of 36 recently installed for evaluation by officials and the public. (Inset shows how similar sign appears at night . . . bright, sharp, colorful and easy to see.) Street-name signs of "Scotchlite" Reflective Sheeting are great boosters for civic pride and progress, friendly aids to residents and visitors alike.

Traffic Control Supervisor Sidney O. Vedder shows old and new signs. The Cedar Rapids high standard of signing follows through from large green directional signs to the regulatory series. *All* reflective signs are now fabricated with prepared faces of "Scotchlite" Sheeting.

New sign fabrication in vacuum applicator (left) is demonstrated by Supervisor Vedder. Reflective green "Drive In Your Lane" guide signs reduce lane-straddling 24 hours a day. (Right) Examples of signs produced by Cedar Rapids' own shop. Easy applicator fabrication cuts costs, improves department efficiency.

Reflective guide signs greet motorists as they enter Cedar Rapids. By night or by day, directions that can be easily seen, easily read and easily obeyed keep traffic flowing smoothly and safely.

In Cedar Rapids the sign standard is SCOTCHLITE

REG. U.S. PAT. OFF.

BRAND

REFLECTIVE SHEETING

MINNESOTA MINING AND MANUFACTURING COMPANY

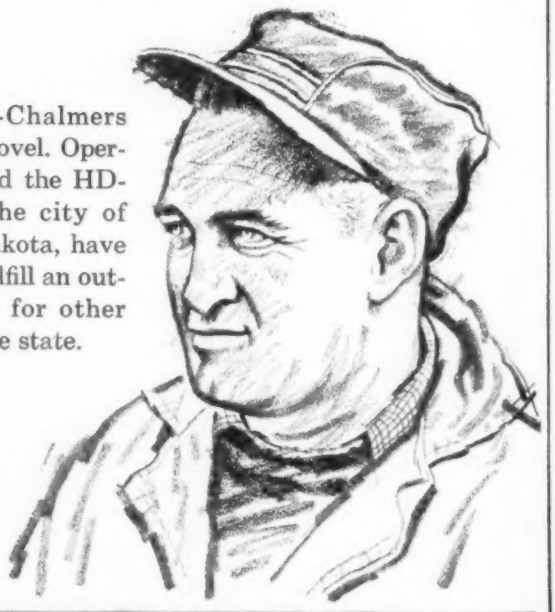
WHERE RESEARCH IS THE KEY TO TOMORROW

3M COMPANY ST. PAUL 6, MINN.

The term "Scotchlite" is a 3M Company trademark

He maintains a model landfill

. . . with an Allis-Chalmers HD-11G tractor shovel. Operator **Don King** and the HD-11G, owned by the city of Mitchell, South Dakota, have made the city's landfill an outstanding example for other municipalities in the state.



HD-11G 32,000 lb weight • 2¼-cu yd bucket • 111 net engine hp

Mitchell landfill features deep, clean disposal

Two things impress observers at this landfill . . . the clean, sanitary appearance and the efficient handling of garbage . . . more than 30 truckloads daily. The man most responsible is Don King who operates the Allis-Chalmers HD-11G on the dump. Don puts a blanket of cover material over new fill every night to keep it in place. The 11-G's 32,000 pounds help compact garbage—make it airtight and vermin-proof.

Operator King likes HD-11G advantages on his kind of work. Its slim cowl and low lines make it easy for him to see as he spreads, compacts and covers. A comfortable seat, clear platform and responsive controls also help make the HD-11G an operator's machine.

Besides keeping a model fill area, it is also used to load 10-ton trucks with sand for street and road work. Average loading time for each truck—only 1¾ minutes.

An Allis-Chalmers tractor shovel in your town can give you the same efficient service.

ALLIS-CHALMERS
CONSTRUCTION MACHINERY DIVISION
MILWAUKEE 1, WISCONSIN

Look ahead... *move ahead* ...and stay ahead with **ALLIS-CHALMERS**

NOW ...a NEW MUELLER®

DOUBLE PRESSURE CHAMBER TAPPING MACHINE...

the B-100

MAKES FASTER TAPS!

ASSURES PRESSURE TIGHT CONNECTIONS!

PROVIDES EASY, TROUBLE-FREE OPERATION!

use it by hand or with power...

FORM NO. W-8912

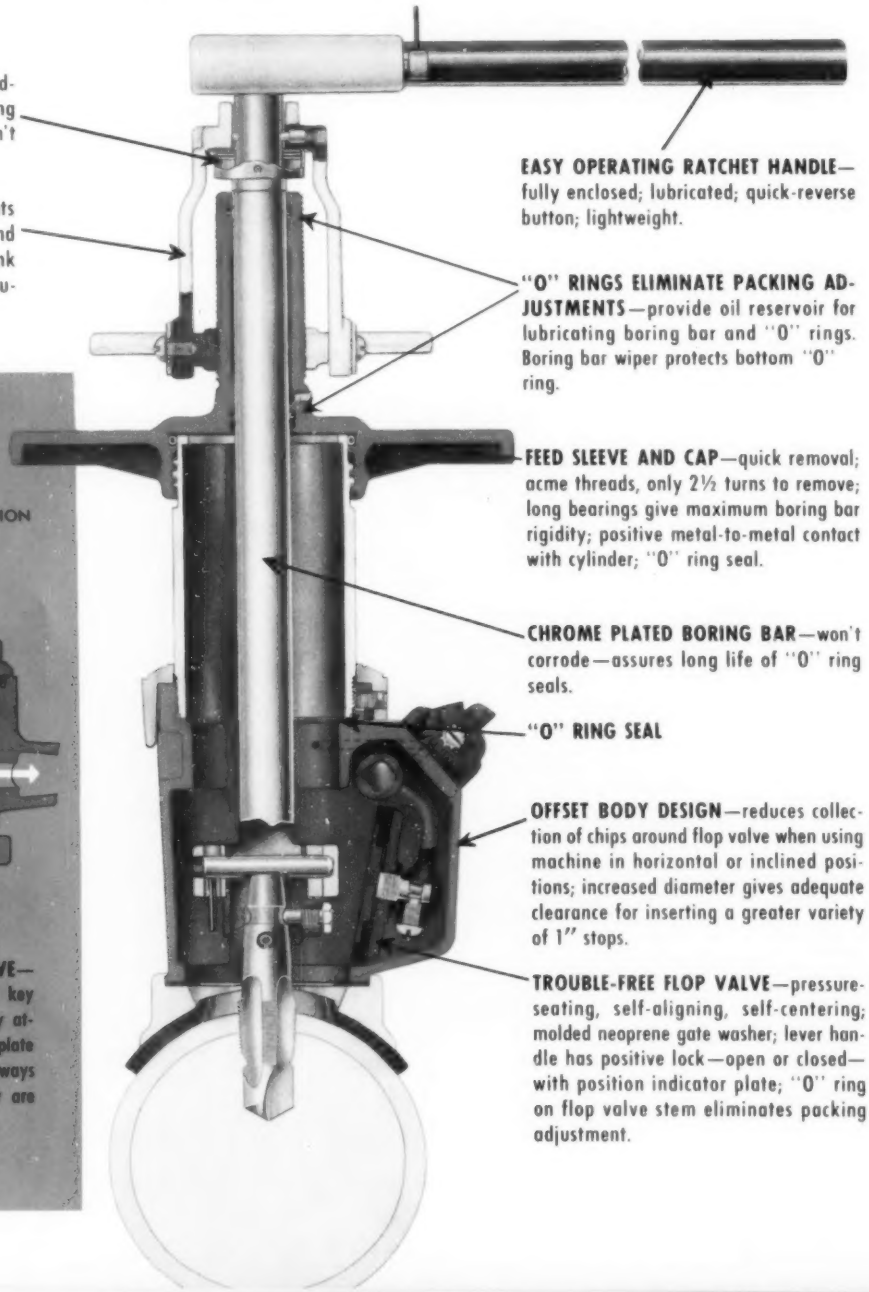
PRINTED IN U.S.A.

Features and Benefits

Fast taps, pressure tight connections and easy trouble-free operation provide an operating efficiency so necessary to meet today's demands. The new B-100 Drilling, Tapping and Inserting Machine gives these results IMMEDIATELY and CONSISTENTLY.

The machine incorporates the same basic double pressure chamber, single boring bar design principle which, through 86 years of field experience, research and testing, has proved to be the most efficient in operation. Its design permits the operator to handle the machine in lightweight sections. The tapping and inserting operations are performed separately. Tool or stop may be safely removed from the machine at any time during the operation for inspection or replacement, if necessary.

The "B-100" is *all new* from the saddle up, and has plus features we know you have wanted. Look over these features—see how they all combine to contribute to faster taps, pressure tight connections and easy, trouble-free operations.



ANTI-FRICTION THRUST COLLAR—sandwich type nylon-teflon-nylon bearing sealed in steel case; no lubrication; won't gall under power operation.

FEED NUT AND YOKE—spring detents hold feed yoke securely in place around boring bar; acme threads; square shank on feed yoke fits power operator for automatic feed.

EASY OPERATING RATCHET HANDLE—fully enclosed; lubricated; quick-reverse button; lightweight.

"O" RINGS ELIMINATE PACKING ADJUSTMENTS—provide oil reservoir for lubricating boring bar and "O" rings. Boring bar wiper protects bottom "O" ring.

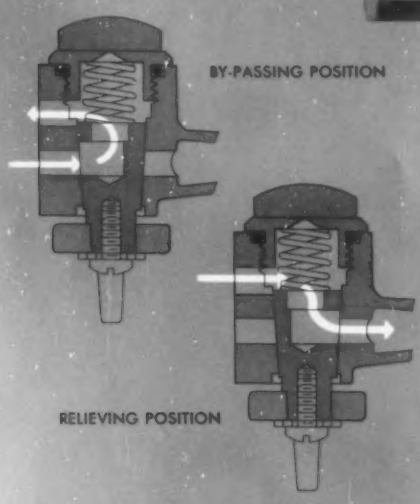
FEED SLEEVE AND CAP—quick removal; acme threads, only 2½ turns to remove; long bearings give maximum boring bar rigidity; positive metal-to-metal contact with cylinder; "O" ring seal.

CHROME PLATED BORING BAR—won't corrode—assures long life of "O" ring seals.

"O" RING SEAL

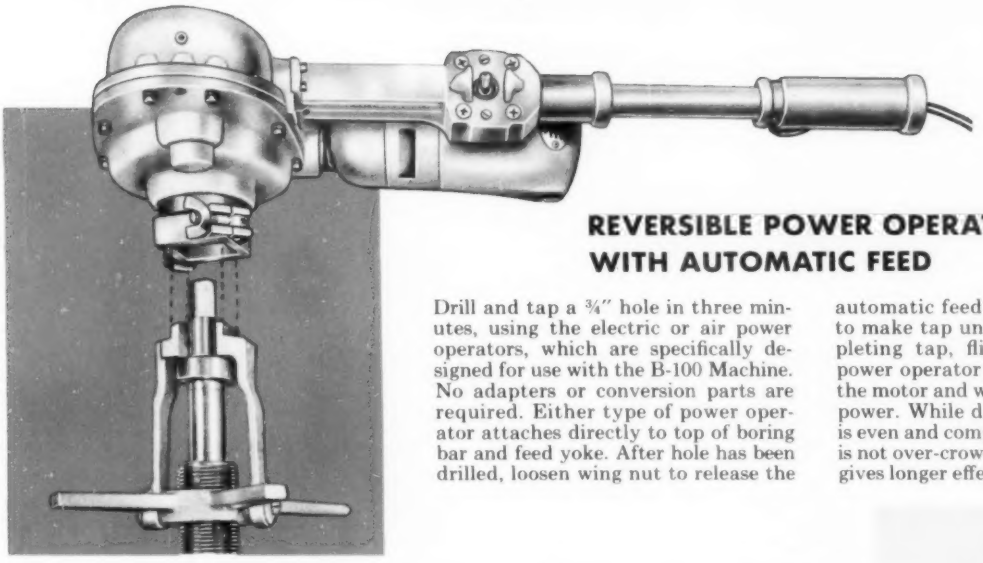
OFFSET BODY DESIGN—reduces collection of chips around flop valve when using machine in horizontal or inclined positions; increased diameter gives adequate clearance for inserting a greater variety of 1" stops.

TROUBLE-FREE FLOP VALVE—pressure-seating, self-aligning, self-centering; molded neoprene gate washer; lever handle has positive lock—open or closed—with position indicator plate; "O" ring on flop valve stem eliminates packing adjustment.



EASILY MAINTAINED BY-PASS VALVE—self-contained, spring-loaded, ground key valve with fluid escape deflector; easily attached; wing-type handle with indicator plate clearly shows position. Straight passageways through ground key valve and body are easily cleaned.

owners and operators will like...



REVERSIBLE POWER OPERATOR WITH AUTOMATIC FEED

Drill and tap a ¾" hole in three minutes, using the electric or air power operators, which are specifically designed for use with the B-100 Machine. No adapters or conversion parts are required. Either type of power operator attaches directly to top of boring bar and feed yoke. After hole has been drilled, loosen wing nut to release the automatic feed driver, then continue to make tap under power. After completing tap, flip the switch on the power operator to reverse direction of the motor and withdraw the tool under power. While drilling, boring bar feed is even and completely automatic—tool is not over-crowded; does not overheat; gives longer effective tool life.

ASSURED RIGIDITY

ON THE MAIN

Pressure-tight connections start with complete machine rigidity on the main. Aluminum alloy chain yoke has high strength—lightweight. Chain hook washers are widely spread and deeply recessed in yoke to prevent slipping off on large diameter pipe. Chain hook cannot rotate—chain cannot twist during tightening. Square shank on chain hook fits inside square hole in chain washer. Square shank on chain washer prevents turning in yoke. Acme threads on chain hooks give long life. Chain hooks, chain hook washers and chain hook nuts are cadmium plated to resist corrosion.

IN THE BORING BAR

Perfect alignment of the boring bar is assured by three boring bar bearings; two, widely spaced in the feed sleeve, and the third at the extreme bottom end of the boring bar. The lower bearing is of molded nylon and closely bears against a machined surface in the body when the drill first contacts the main and also when the stop is being inserted. Curvature of the pipe cannot deflect the drill—tools are relieved of unnecessary stresses and give longer effective life. These three widely spaced boring bar bearings assure perfect centering of tool and stop for accurate threading and a pressure-tight connection.

NEW TOOL RETAINER WITH INDEPENDENT DRIVE

Drive pins in shank of new combined drill and tap or E-Z Release Screw Plug slip into notches in the boring bar socket. All driving force is exerted against these drive pins, preventing damage to the surface of the tool shank. Tool retaining screw in replaceable bronze sleeve bears against the upper part of a circular groove around tool shank—holds tool tight in boring bar socket. This new holding and driving arrangement assures perfect tool-boring bar alignment and maximum rigidity, for long tool life.

No problem to remove tools in the "B-100". Just loosen the tool retaining screw, tap the knockout pin in the tool holder and the tool slides out in your hand.

MUELLER®

B-100 DRILLING, TAPPING AND INSERTING MACHINE

CAPACITY AND USE

The B-100 Machine will drill and tap the main and insert the following items under pressure: corporation stops and gas main stops ½" through 1"; machine inserted valve tees ¾" and ¾"x1"; and pipe plugs ½" through 2½".

Combined drills and taps and screw plugs are not interchangeable between the B and B-100 Machine. Saddles are interchangeable with the B Machine.

WORKING PRESSURE

90 p.s.i. without power clevis.
250 p.s.i. with power clevis.

B-100 MACHINE AND EQUIPMENT FURNISHED

Ratchet handle
Small saddle gasket
Large saddle gasket
Chain hooks and nuts
Chain washers
Round link chain
Chain hook nut and tool retaining screw wrench
Body cleaning chisel
Lubricating oil
Cutting grease

Shipped in strong wooden chest. Total shipping weight 97 pounds.

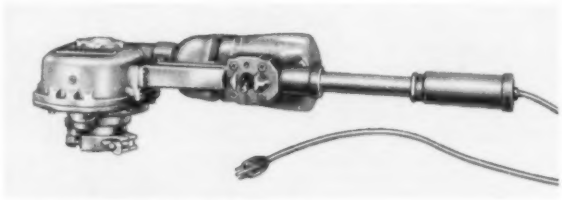
Handling weight during operation: upper section 19 pounds; lower section 23 pounds.

EQUIPMENT TO BE SELECTED

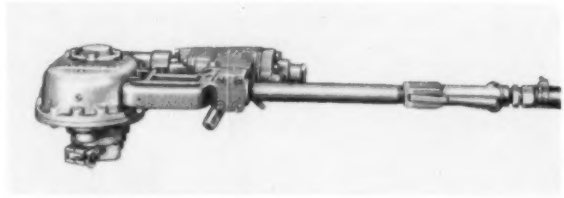
Combined drills and taps
Saddles
Screw plugs
Extracting tools

OPTIONAL POWER OPERATORS

Electric or air power operators are offered as optional equipment for use with the B-100 Drilling and Tapping Machine. Either unit is suitable for 1" taps through any kind of pipe. Drive spindle turns at 35 r.p.m.—motors are reversible.



H-603 ELECTRIC POWER OPERATOR
110-120 volt A.C. or D.C.



H-604 AIR POWER OPERATOR
90 p.s.i. pressure (full load)

OPTIONAL EQUIPMENT FOR SPECIAL USES

Power clevis
Chain spreader
Corporation stop wrench
Round link extension chains
Long Ratchet Handle Bar (used for drilling and tapping operations on cuts over 1" in size).

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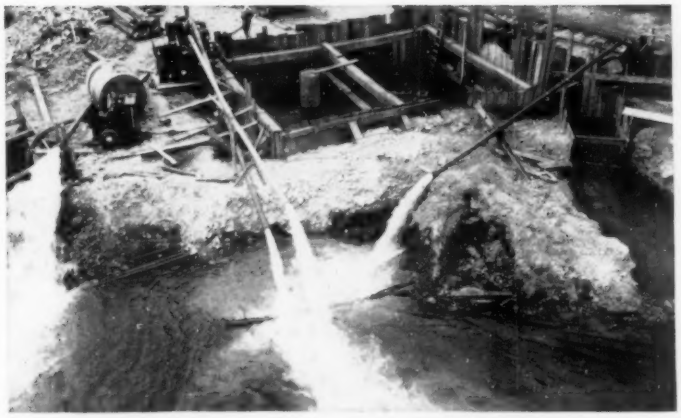
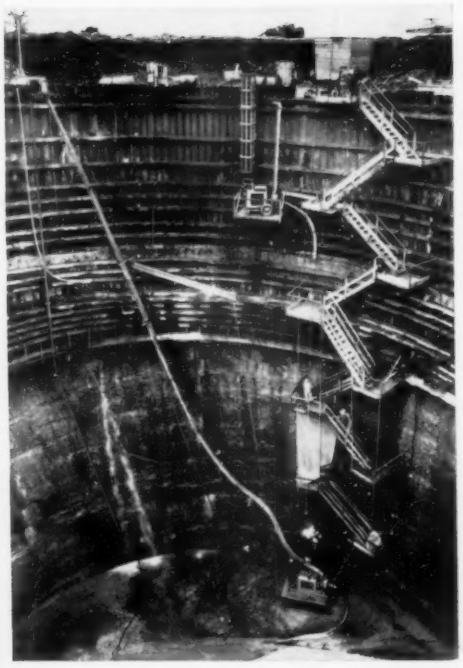
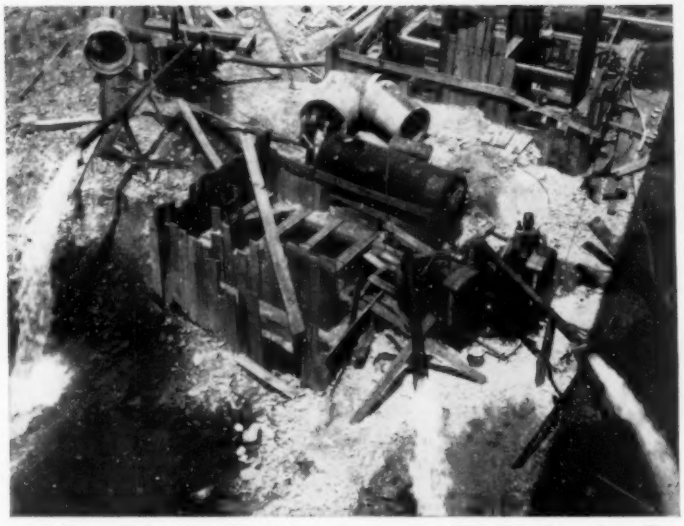
DECATUR, ILL.
Since 1857 SERVING the Water and Gas Industries
Factories at: Decatur, Chattanooga, Los Angeles.
In Canada: Mueller, Limited, Sarnia, Ontario







Four of the many pumping operations on Pittsburgh project. Riverside location meant handling heavy inflow.

Over 2 million gallons an hour with Jaeger pumps

For both low and high head pumping, 7 of the contractors on Pittsburgh's new $100 million sewer system used 51 Jaeger pumps with a total water handling capacity exceeding 2,000,000 gph

A Jaeger "Sure Prime" pump has four things that you don't get in ordinary pumps—a bigger shell and impeller, an engine of the largest horsepower applicable, a positively lubricated shaft seal and two independent, simultaneous priming actions.

As a result you get doubly-sure fast priming without racing your engine, big capacity at much slower operating speed, high efficiency and longest life from both pump and engine. *Base your pump buying on today's performance.* See your Jaeger distributor or send for latest catalog.

THE JAEGER MACHINE COMPANY

400 Dublin Avenue, Columbus 16, Ohio

AIR COMPRESSORS • CONCRETE MIXERS • TRUCK MIXERS • PAVING SPREADERS and FINISHERS

IN
WASHINGTON
STATE...
OVERLAID FIR
DUPONT
FT. LEWIS
NEXT RIGHT
1/2 MILE
WASHINGTON STATE HIGHWAY DEPARTMENT
TRAFFIC ENGINEER: Rex G. Still
SIGN ENGINEER: Alan L. Solberg

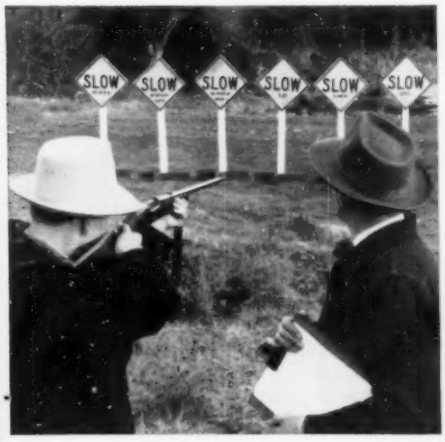
PLYWOOD SIGNS SHOW THE WAY

WASHINGTON STATE highway officials guide motorists with modern color-coded reflectorized signs of overlaid fir plywood. And because they cost less and last longer than metal signs, they mean important savings for taxpayers, too.

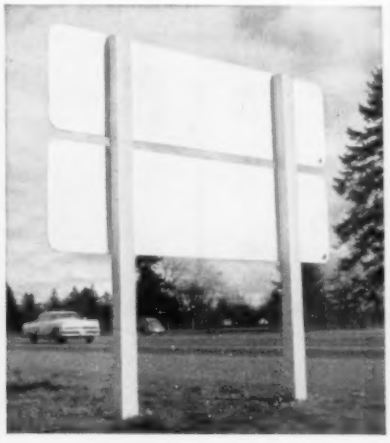
The state has standardized on High Density overlaid plywood for all large directional and informational signs. Reflective sheeting is applied direct, without prime coats. This elimination of painting saves money and the plastic-like high density overlay provides a better and more foolproof bond for the reflective sheeting. Backs are painted only where special colors are required.

For smaller warning and regulatory signs, Washington uses both High and Medium Density overlays. In the case of Medium Density, panels are primed before reflectorizing.

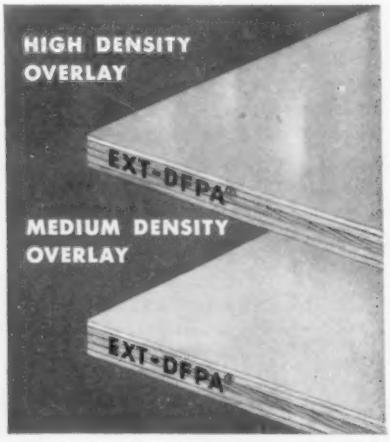
Washington has found that overlaid plywood signs stand up better under severe weathering and accidental or deliberate abuse. There is no rust, corrosion or other progressive deterioration after damage. Plywood signs are stronger and stiffer, too, and require fewer posts and framing members. Panels are light and easy to handle.



Vandalism tests conducted by Douglas Fir Plywood Association show plywood signs far stronger and more durable than steel or aluminum. Bullet holes, for example, are clean, sharply defined, with limited impact area. Write for test report.



Strength and stiffness mean larger size (up to 4′ x 8′) plywood signs can be installed without backing or framing. On king-size shoulder mounted or overhead signs, supporting framework is greatly simplified. Panels are light, easy to handle.



Durable overlay eliminates checking, grain raise. High Density overlay needs no paint protection; reflective sheeting may be applied direct. Medium Density is for plain painted signs. Base panel is waterproof Exterior (EXT-DFPA*) plywood.

FOR MORE INFORMATION (detailed specifications, application data, etc.) write to:

DOUGLAS FIR PLYWOOD ASSOCIATION
TACOMA 2, WASHINGTON
—a non-profit industry organization devoted to research, promotion and quality control

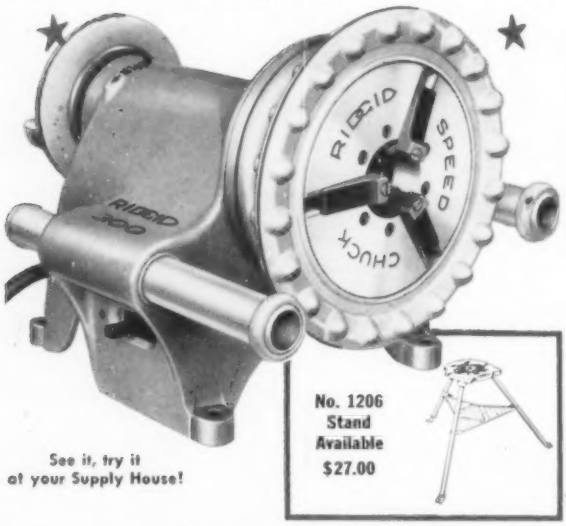
DFPA TESTED QUALITY

Introducing...
the ALL-NEW
RIDGID
300
Power Drive

$199.50

- Full ⅛" to 2" capacity
- Light-Weight · Heavy-Duty
- Unmatched RIDGID Quality

Patents Applied For



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Stand
Available
$27.00

See it, try it
at your Supply House!

Designed and Manufactured by
THE RIDGE TOOL COMPANY
ELYRIA, OHIO, U. S. A.

COMMENTARY on WATER and SEWAGE TREATMENT

Sludge Thickening

R. S. RANKIN

Consultant, Water and Sewage Treatment

SLUDGE THICKENING ahead of digestion, first proposed by Torpey and now being practiced in an increasing number of plants, yields some useful results and worthwhile returns on the investment. Sludge thickening as discussed herein is the continuous withdrawal of solids from the treatment process at relatively high dilutions, feeding the dilute mixture into a separate thickener, overflowing the excess liquid and transferring the thickened sludge to the digester. Practical questions are what are the benefits of this additional operation and what is the minimum size of plant which can justify its use.

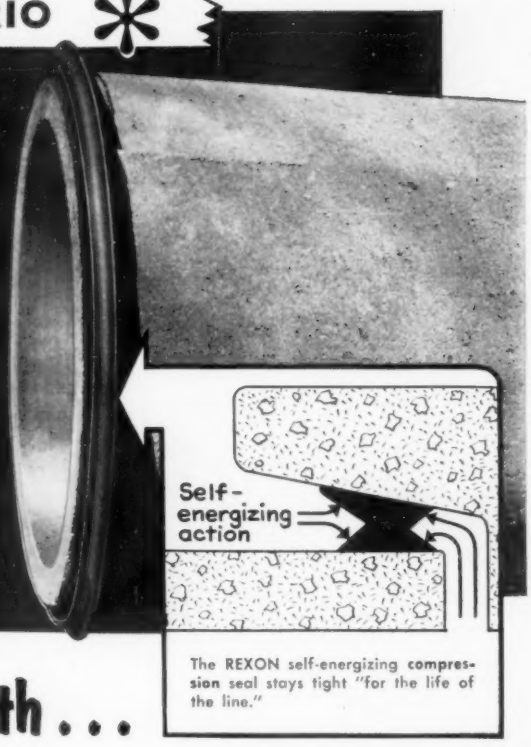
The primary benefit of thickening ahead of digestion is to reduce the volume of sludge going to the digester and thereby reduce the required capacity of the latter. Other benefits include a reduction in volume of sludge to be heated, lower radiation losses from smaller digesters and the complete elimination of septic digester supernatant which in the conventional plant is invariably returned to the treatment process. Another incidental benefit, therefore, is improvement in overall plant performance.

This method of thickening is most suited to plants having complete or biologic treatment with primary and secondary sludges which are collected separately and fed at different rates into the thickener. Sludge from the secondary or biologic treatment stage is usually fed at about eight times the volumetric rate of that from the primary stage. The secondary sludge will usually carry sufficient dissolved oxygen to maintain aerobic conditions in the thickener providing the detention of the solids is properly controlled. The thickener overflow which is aerobic and similar to the raw sewage can be returned to the system with none of the adverse effects of digester supernatant. Because of the finely divided state of the solids it is usually returned to the biologic or secondary treatment portion of the plant.

The area of the thickener is based on either of two factors: Solids or liquid loading, whichever is larger. Solids loading varies from 8 lb. per sq. ft. per day for conventional activated sludge plants to 12 lbs. for trickling filter plants, and up to 20 lbs. for plants using modified aeration. Liquid loading at a maximum of 800 GPD per sq. ft. is preferred. These loadings include the combined primary and secondary sludges. Solids concentration in the combined feed will vary from 1000 ppm to 3000 ppm which is obviously very diluted compared to customary sludge concentrations. Centrifugal pumps are used for secondary sludges and for primary sludges where there

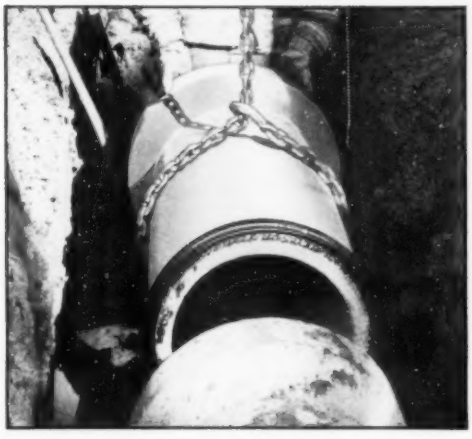
In WALLACEBURG, ONTARIO *

REXON®
Rubber
PIPE GASKETS



The REXON self-energizing compression seal stays tight "for the life of the line."

"PAY OFF" with . . .



*PROJECT: Sanitary sewer, Wallaceburg, Ontario.
ENGINEERS: William D. Colby, Consulting Engineer, Chatham, Ont., and E. Crombie, Town Engineer.
CONTRACTORS: Oakland Construction Company, Galt, Ont.
PIPE: 6" to 15" C-14 Concrete Pipe with REXON Gaskets, manufactured by Niagara Concrete Pipe Ltd., St. Catherines, Ont., Canada, a subsidiary of American-Marietta Co.

WATER-TIGHT JOINTS—Rexon Light-Duty Infiltration Gaskets seal with self-energizing action . . . the greater the water pressure, the tighter the seal becomes, as shown in the diagram. Rexon Gaskets assure the same fast coupling for small diameter bell and spigot pipe as its heavy-duty companion gasket, TYLOX, does for tongue and groove pipe.

FAST PIPE-LAYING—REXON Gaskets quickly "snap-on" to the pipe, and the pipe is quickly coupled into the line. Flexibility of the rubber compensates for pipe angularities . . . permits wet trench jointing . . . immediate backfilling.

ACID IMMUNITY—REXON Gaskets are made of rubber specially compounded to resist sewerage and industrial waste acids and alkalies. Under ground and under compression, they outlast the life of the pipe itself.

WRITE FOR BROCHURE giving specifications and engineering data on REXON Rubber Gaskets. Developed **specially** for small diameter bell and spigot concrete pipe, they are the most significant advancement in rubber sewer pipe couplings since TYLOX itself.

5112

HAMILTON KENT
MANUFACTURING COMPANY
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CANADIAN PLANT: 10 Brussels St., New Toronto, Ont. Phone CLifford 1-2494

Hopto® 180 SERIES
HYDRAULIC EXCAVATOR

This Hopto 180 series excavator mounts on your industrial tractor to give you all the features and performance of bigger machines.

The 180 has a digging depth of 10 feet, full 180° uninterrupted swing and a dumping height of 8½ feet. Operation is fully hydraulic with a 24 gpm pump powering boom, dipper stick, bucket controls and levelling outriggers. Control is swift, safe and sure with every action hydraulically cushioned.

Conservatively rated at ¼ yard capacity, the Hopto 180 can also be fitted with ⅛ yard buckets for specialized work. Backhoe and shovel buckets are interchangeable in five minutes.

Mail the coupon below for complete information on the Hopto 180 excavator. Then check with your distributor for an on-the-job demonstration!

Get all the facts and you'll get Hopto!

Hopto® ®Reg. U.S. Pat. Off.

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BADGER DIVISION • DEPT. PW • WINONA, MINNESOTA

Please send me complete information on the Hopto 180 series hydraulic excavator.

NAME_____

ADDRESS_____

CITY_____ STATE_____

is sufficient volume, otherwise plunger pumps with intermittent time clock control are used.

Continuous Thickening

Results show that it is quite practical to thicken continuously the combined sludges to such an extent that the resulting volume in trickling filter plants is less than 40 percent of the volume obtained by conventional methods and in activated sludge less than 45 percent. This reduction in volume is attributed in part to the removal of excess water from the raw undigested sludge. The digestibility of the sludge is unaffected by thickening. Stated in terms of solids concentration, it is practical to produce thickened sludge continuously from trickling filter plants with 7 to 8 percent solids, from conventional activated sludge plants with 6 to 7 percent solids, and from modified aeration plants with 10 percent solids.

With the volume of sludge going to the digester only 40 to 45 percent of that obtained by conventional methods, the digester capacity needs to be only 40 to 45 percent of that customarily used to provide the same detention time, the real factor in determining digester performance. In existing plants, the addition of sludge thickening will enable the digesters to handle twice their previous load. In new plants, capacities can be halved but it is generally necessary to obtain approval of regulatory agencies because most of them have long-established yardsticks for digester capacities.

Current practice, applying the per capita capacities stipulated by these agencies, results usually in digesters with about 50 days detention of raw feed. With thickening these same unit capacities would result in digesters with 110 to 120 days detention, obviously an absurd length of time. Therefore, the first objective when applying sludge thickening to a new plant is to secure the necessary approval to make the capacity proportional to the anticipated sludge volume. For 50-day detention, this volume is 40 or 45 percent of that previously required.

The reduction affords a direct saving in cost but part of the saving must be applied toward the thickener installation. However, the volume of the thickener is only about 10 percent of the volume of 50-day digesters based on reduced sludge volume. Thus, if the conventional digester volume is represented by 100 percent, the digesters with prethickening will have a total volume including the thickener of less than 50 percent of the conventional. Costs per cu. ft. of capacity can be applied to determine actual monetary saving.

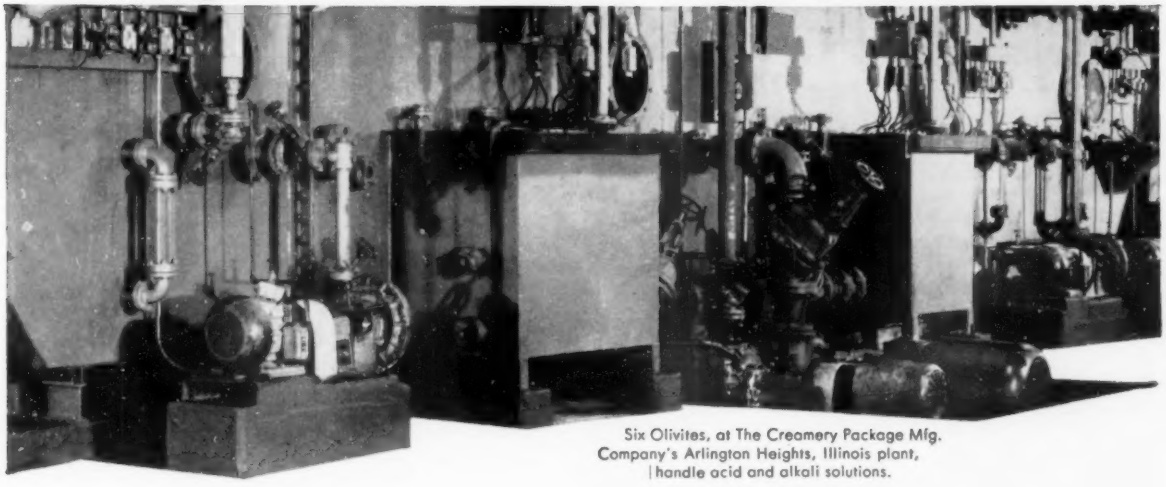
Where a 50-day detention is mentioned, it is assumed that approximately one-half, or 25 days, will be provided in a primary digester equipped with heating and mixing, and the other half will be in a secondary or storage tank. Transfer from primary to secondary is continuous with no supernatant withdrawn from either primary or secondary, as the excess liquid has been withdrawn ahead of digestion. A detention of 25 days is by no means critical, in fact, a detention of 15 days is practical, but 25 days decreases the area of controversy.

Plant Size Limitations

As to the size of plant to which this method of thickening is applicable, obviously there is no upper limit, but there is probably a lower practical limit. As mentioned, primary and secondary digestion units

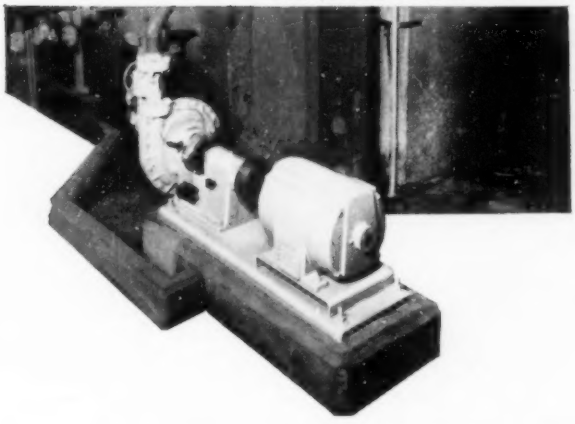
FROM DORR-OLIVER

for tough acid and trade waste pumping problems

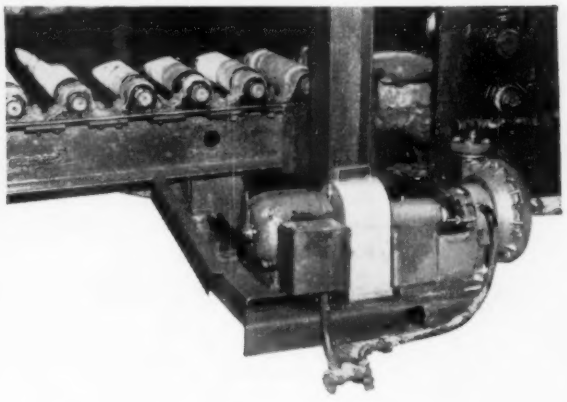


Six Olivites, at The Creamery Package Mfg. Company's Arlington Heights, Illinois plant, handle acid and alkali solutions.

Hydrofluosilicic acid transfer service at Chicago's South District Filtration Plant



Handling pickle liquor on scrubbing and drying line at Gary Sheet and Tin Mill, this Olivite has given excellent service for over three years.



the HYPALON LINED OLIVITE PUMP

The OLIVITE acid handling pump . . . a product of more than 30 years of specialized pump development, provides maximum protection against corrosion and leakage as well as the ability to withstand a considerable range of temperatures.

Now available exclusively with casing, cover and impeller protected by a heavy covering of E.I. duPont de Nemours & Company's new elastomer "Hypalon," the OLIVITE pump is virtually hand-tailored for applications involving either highly acidic or alkaline material.

Currently available in 1½", 2" and 4" sizes. Complete information in the new Dorr-Oliver Centrifugal Pump Bulletin, just off the press.

Write: Dorr-Oliver Incorporated, Stamford, Connecticut.

Hypalon—Reg. T.M. E. I. duPont de Nemours & Co.

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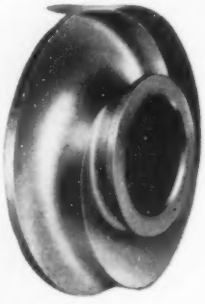
HORIZONTAL & VERTICAL
MONO-VANE
SINGLE PASSAGE IMPELLER
PUMPS

The response to our new MONO-VANE Non-Clog Pumps was instant and gratifying. We thought you, too, would find interest in this STEP FORWARD in non-clog pumping technique.



PATENT PENDING

NO SEPARATE COUNTER-BALANCE is REQUIRED

Other head and capacity requirements may be obtained by the mere trimming of the impeller. The impeller is ALWAYS in DYNAMIC and HYDRAULIC BALANCE — a major advance in non-clog pumping.

AREAS of APPLICATION

Handles Long Stringy Solids Better than Conventional Non-Clog Impellers • Suited for Industrial By-Products • Semi-Solids • Wastes • Municipal Sewage Plants • Lift Stations • Buildings.

VERTICAL—MONO-VANE PUMPS—HORIZONTAL

These advanced pumps with the exclusive Aurora Mono-Vane Impeller are available in both horizontal and vertical types with 3" to 5" (Suction-discharge diam.). Operation is smooth and quiet. Discharge may be turned to various positions. Casings are provided with cleanout opening. Detachable suction and packing covers provide ready access.

Type KU Aurora Vertical Mono-Vane Non-Clog Pump

Type KGG Aurora Horizontal Mono-Vane Non-Clog Pump

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AURORA PUMP DIVISION
THE NEW YORK AIR BRAKE COMPANY

89 LOUCKS STREET • AURORA • ILLINOIS

EXPORT DEPARTMENT — Aurora, Illinois — Cable Address "NYABINT"

are employed. Assuming that the minimum practical size is 20 ft. diameter then two such units 12 ft. deep will have a volume of about 8000 cu. ft. On the basis of 50 days total detention, the daily volume of raw sludge would be 160 cu. ft. At 8 percent solids in the raw sludge, this volume represents 800 lb. of dry solids per day, which is the equivalent contribution of 4500-5000 persons per day. The minimum practical size of thickeners is 10 ft. diameter which is just about right for this assumed condition. Therefore, from the practical standpoint, plants serving populations of 5,000 and larger can justify this method of reducing initial costs and likewise obtain the benefits.

Where digested sludge is filtered on vacuum filters, one adverse factor to be considered is the increase in alkalinity of the sludge. Digested thickened sludge will have an alkalinity of 4000 to 5000 ppm. which would require a considerable increase in conditioning chemicals. Two-stages of elutriation, however, will reduce this alkalinity to a level comparable to that in conventional operations.

The thickener-digester combination described herein is covered by issued patents but several companies are empowered to grant license rights.

• • •

Reinforcing a Water Main Under An Airfield Landing Strip

When an airfield landing strip is going to be laid directly over a water main which was laid in 1929, the problem is what to do. Love Field, Dallas, Tex., plans to construct an airstrip as a part of its expansion program directly over a 36-in. bell and spigot cast-iron water main of the Dallas Water Works. The water line has normal and extreme depths of cover of 4½ and 10 feet. Carrying a working pressure of 120 psi, the main is a transmission line from Bachman Pumping Station to a 21-million gallon reservoir 7 miles distant.

Under the direction of J. D. Henry, Supervisor of Distribution and A. A. Walker, Construction Engineer, the portion of the line affected was uncovered and every joint was thoroughly cleaned. Next the line was clamped, using 77 Dresser Style 60 bell joint clamps. Throughout the entire operation the line was in continuous service and the project was performed without difficulty. H. J. Graeser is Superintendent of the Dallas Water Works.

Variable Pitch Blades for Sewage Pumps

At the Derby, England, reconstructed sewage treatment plant, pump stations are used to deliver sewage to the secondary filters, using the double alternating principle. The three pumping sets in each station have variable pitch axial flow pumps driven by constant speed electric motors. The pitch of the pump impeller blades is automatically controlled from the sump level by floats to enable the pumping rate to match the inflow. Starting and stopping is also controlled by the sump level. If the rate of inflow exceeds pump capacity, a penstock opens automatically and the filter then operates on single filtration.

Special Assessments for Repaving Streets

The city of Eau Claire, Wisc., according to Wisconsin Municipalities, has recently revised its special assessment policies to provide for charging abutting owners for street repaving. The revised policy affecting the resurfacing of streets provides as follows:

. . . and only straight Sterling Rock Salt gets right down to the pavement through ice or hard-packed snow!

What's behind the big trend to straight rock salt for ice control? The answer is that abrasives—even when mixed with salt—just can't produce the bare pavements so vital during winter storms!

Sand and cinders don't melt hard-packed snow . . . have no effect on ice, sleet and freezing rain. They give very limited traction because wind and traffic quickly scatter them to the side of the road. And what's left is soon covered by as little as ¼" more snow. Cleanup of abrasives is a costly, messy job, too.

In contrast, straight Sterling Rock Salt is a powerful *melting* agent. It helps turn snow into slush—quickly. When ice forms, salt crystals bore through to the road surface. Here, brine is formed and spreads out to break the bond between ice and pavement. Ice can be easily removed so you get a bare, safe pavement.

Other economies. One truckload of straight Sterling Rock Salt covers as long a stretch of road as 8 truckloads of abrasives. You make fewer trips to take care of a storm. And Sterling Rock Salt leaves *no* spring cleanup jobs. Now's the time to complete your stockpiling of Sterling Rock Salt. Winter demands can make deliveries uncertain. Contact your International representative or the nearest sales office.

FREE "BARE PAVEMENT MAINTENANCE" BOOKLET. Ask your International representative or write for your copy soon. It's an up-to-date, comprehensive guidebook on all aspects of ice control. Can be helpful in your winter program . . . whether it's municipal, county or state.

INTERNATIONAL SALT CO., INC., SCRANTON, PA.

SALES OFFICES:

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STERLING "Auger-Action" ROCK SALT

INTERNATIONAL SALT COMPANY, INC.

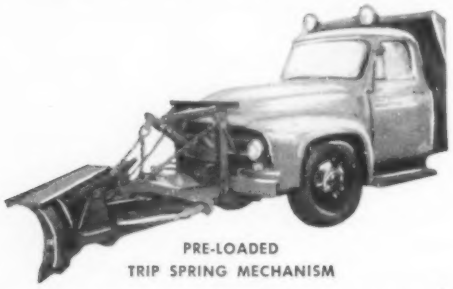
Versatile Reversible!

The NEW **FRINK**

TRIP-BLADE SNO-PLOW

for all-purpose snow removal

Here's the plow designed to cope with almost every snow removal problem. The new Frink Reversible Sno-Plow with Trip Blade plows left or right for in-city maneuverability . . . bulldozes straight ahead for clearing intersections, bridges, lanes, parking lots, airport ramps and wide sidewalks. Power hydraulic mechanism, controlled by cab lever, reverses plow while raised or on ground, even while plowing. (Models with manual reverse by single lock pin also available.) Curved, panelled moldboard with deflector makes the Reversible lighter and safer to use at all speeds.



PRE-LOADED
TRIP SPRING MECHANISM

Dual-purpose springs with special linkage to moldboard create "free-flowing" action that follows road contour, produces smooth tripping over obstructions and quick, cushioned rebound without chatter. Cutting edge and plow shoes are replaceable; scuff shoes bolted outside moldboard protect against curbs, side obstructions.

Other dependable Frink Sno-Plows (V-Type, One-Way and Roll-Over) are interchangeable on trucks with attachments for the Reversible.

For Snow Plow Know-How It Pays to Think of FRINK SNO-PLOWS

Clayton, 1000 Islands, N. Y.
Frink Sno-Plows of Canada, Ltd., Toronto, Ontario

1. Average Residential Streets: an average residential street for the purposes of this assessment policy is a minor residential street which is 30 feet in width between the faces of the curbs.

Property abutting such a residential street will, on a front foot basis, be assessed for the entire cost of the resurfacing.

2. Other Streets: a property owner whose property abuts on a street which is not an average residential street will be assessed either the entire cost of the resurfacing, or on a front foot basis as though the street on which his property abuts were an average residential street, whichever is the lesser of the two.

3. In general the life span of a paved street surface for the purposes of this policy is determined to be 25 years. Should a street require resurfacing before the end of this period, the abutting property will be assessed on a proportionate basis. For example, should such a street require resurfacing after 15 years, the abutting property would only be assessed for three-fifths (3/5) of the applicable rate.

The cost of resurfacing that portion of any street which exceeds 30 feet in width, the cost of higher quality resurfacing than average residential street resurfacing, and the cost of resurfacing intersections will be borne by the city.

On corner lots, the city will absorb 50 per cent of the cost in resurfacing the street on the flankage side, but in no instance will the city pay for more than 66 lineal feet.

Interstate System Design for New Mexico

Federal funds for the Interstate System allocated to the state of New Mexico for the 1957 fiscal year were $14,227,000; for the 1958 fiscal year, $20,640,000; and for 1959, $24,282,000. With the exception of a relatively few miles of lightly traveled road in sparsely settled areas, the Interstate routes will be divided highways of at least four lanes, built for speeds of 70 mph in flat country, 60 mph in rolling terrain, and 50 mph in mountainous or urban areas. The Interstate highways will cross over or under local and ranch and farm service roads, but a very few intersections at grade will be permitted on those two-lane highways where traffic is light. Driving lanes will be at least 12 feet wide; usable shoulders will be at least 10 feet wide in flat or rolling terrain and 6 feet on mountain roads; median strips will be at least 36 feet wide in flat or rolling terrain, at least 16 feet wide in urban or mountainous areas, and 4 feet wide in especially rugged country.

Snow and Ice Control in Erie County

An important part of the duties of the Erie Co., N. Y., Department of Highways is snow removal and ice control on 1160 miles of county roads and snow removal on 450 miles of state roads. The erection of 100 miles of snow fence in critical areas helps to keep severe snowfalls from blocking the roads.

Composting Planned For Bangkok Refuse

The new compost plant planned for Bangkok, Siam, will be the largest mechanized composting plant in the world. Contract for its construction has been awarded to John Thompson Industrial Constructions Ltd. of London, England, in conjunction with Compost Engineers, Ltd., also of London. The plant will handle the garbage from a million population and will produce 80,000 tons of high grade compost per year. This compost wil be sold for fertilizer and it is expected that the resulting profit will more than cover the cost of the plant and its operation.

Sloped trench licks cave-ins on Denver waterline

Digging 6 feet deep in loose sandy loam, this Cleveland 240 sloped trench from 90-inch top width to 34-inch bottom width, eliminating serious cave-ins. Picture shows its 30-inch wide, power-shift conveyor easily discharging the large-volume spoil.

Owner Fred Linneman of Denver uses his versatile 240 on many different types of trenching jobs, averages 20 feet of trench per minute on small mains and service lines in this area. Transport is no problem since the 240 is only 8 feet wide overall and its conveyor power folds to within this width.

The Cleveland 240 digs down to 6'3" deep, covers a wide range of trench widths. Get full information now.

Good Everywhere ®

The CLEVELAND TRENCHER Co.

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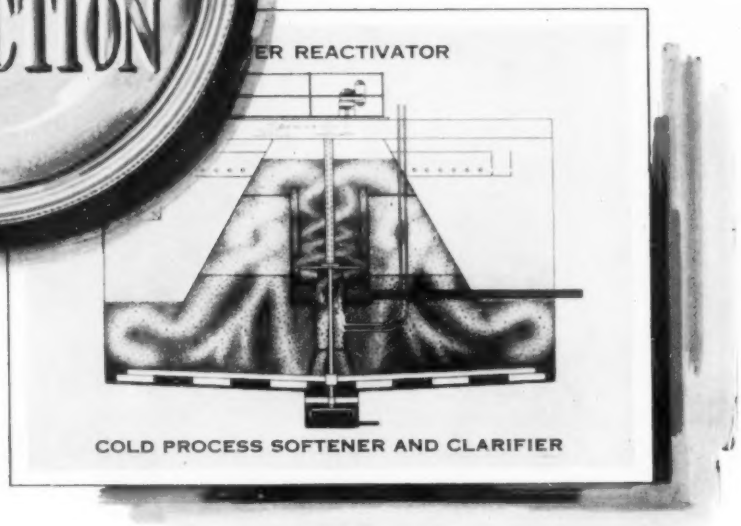
DESIGN of DISTINCTION



The distinctive design of the Graver Reactivator®, proven in hundreds of installations, combines *all* four of these important features in *one* unit: *1. Controlled Sludge Recirculation, 2. Separately driven Sludge Scraper, 3. Low Sludge Level, 4. Sludge removal over entire bottom area*

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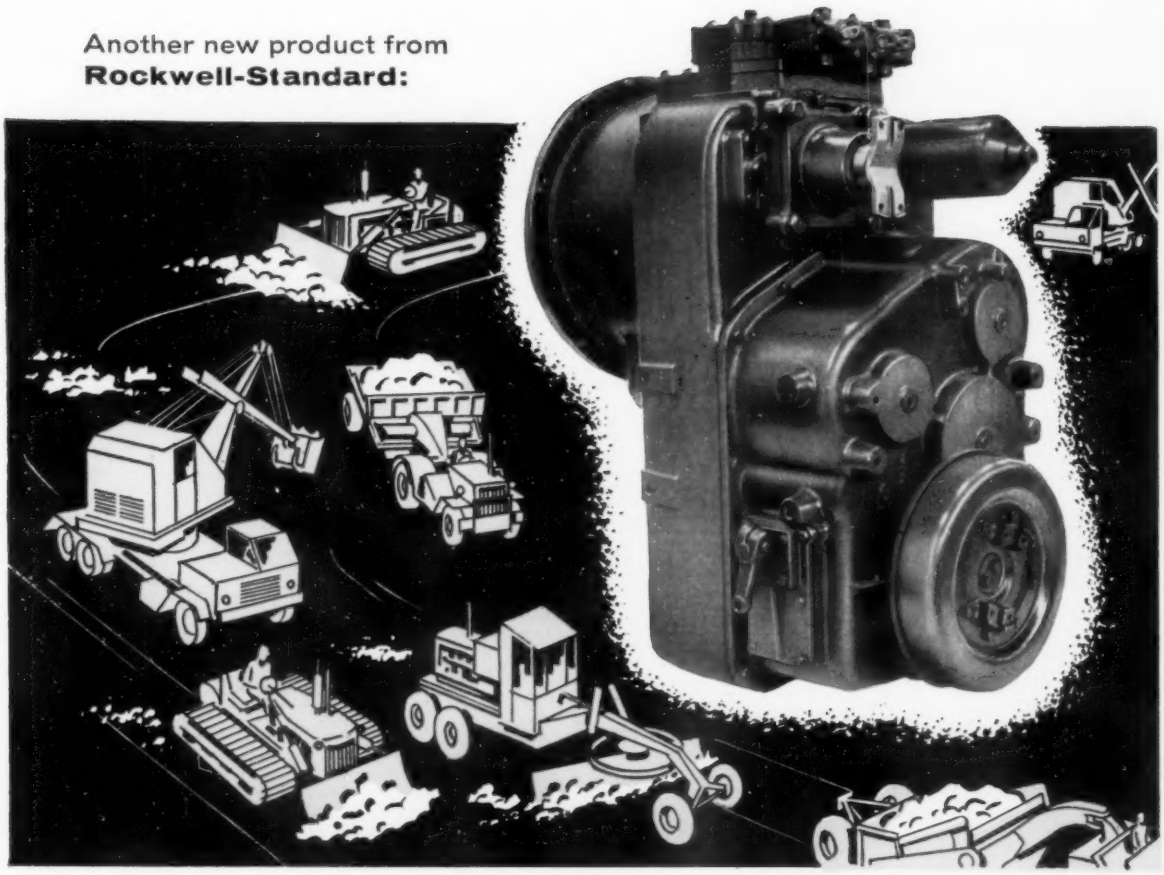
Another new product from
Rockwell-Standard:



HYDRA-DRIVES®
POWER SHIFT TRANSMISSIONS

A torque converter...and 4 speed transmission in one compact package!

Hydra-Drives Power Shift Transmissions put *more* power to work . . . smoothly . . . efficiently . . . economically. Proved in hundreds of vehicles for three years, these units assure top work output of heavy-duty equipment. Engine lugging and heavy shock loads are eliminated. A 3 to 1 torque multiplication makes starting fast and effortless—even with heaviest loads.

Simple to operate, too, a flip of the operator's lever accomplishes power shifts within each range and without any interruption of the power flow. Automatic features of the converter and ease of power shifting simplifies operator training and lengthens vehicle life.

With four speeds forward and reverse, the Hydra-Drives Power Shift Transmission is ideally suited for vehicles which must travel in both directions during a normal work cycle. Rated at 550 ft. lbs. input torque, they can be used with a wide range of internal combustion engines up to 250 H. P.

The Transmission and Axle Division of Rockwell-Standard specializes in drive components only, and *does not compete with manufacturers of end products.* Take advantage of 50 years' experience in the manufacturing of power transmission components, specify Rockwell-Standard.

HYDRA DRIVES
ROCKWELL-STANDARD CORPORATION
TRANSMISSION AND AXLE DIVISION
DETROIT 32, MICHIGAN

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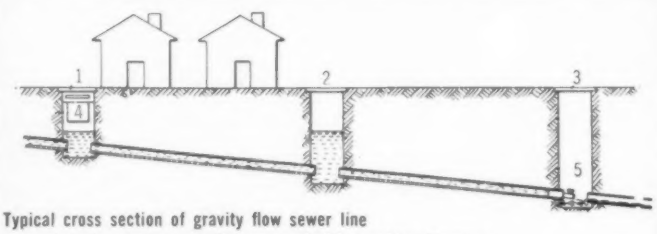
Remarkably Successful!

CLOROBEN CHEMICAL ROTATION METHOD

Provides Effective and Economical Sewer Maintenance, Positive Control of Grease and Odors

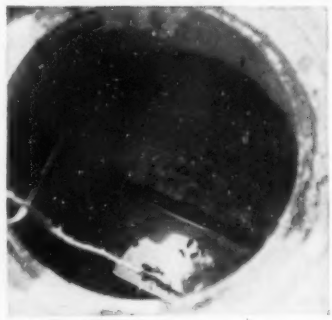


Typical cross section of gravity flow sewer line

In manhole 1, a dosing tank (4) is suspended for applying Cloroben. In manhole 3, adjustable flow-stop mechanism (5) is inserted in the intake of sewer opening to stop flow until sewer is filled. The backed up flow causes manhole 2 to fill partially with Cloroben solution.

1) Easy to use. Cloroben requires no special equipment or handling. Here's how its simply added to a manhole.

THE CLOROBEN UP-SEWER CHEMICAL ROTATION METHOD



2) Result: Sewers free of grease, slime, and insects. Note objects floating through this manhole are dead roaches driven out and killed by Cloroben fumes.

Subject of authoritative articles* by sewage treatment superintendents, the Cloroben Up-Sewer Chemical Rotation Method (U.S. Pat. Applied For) has been generating great enthusiasm throughout the country.

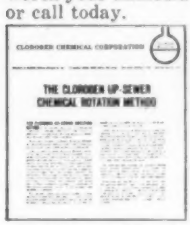
*Including feature story by Fred Funnell, Supt. of Sewage Treatment, Fort Lauderdale, published in "The Overflow", feature story by George Lusk, Supt. Sewage Treatment Plant, Hollywood, Fla., published in American City, July, 1958, etc. Copies of these articles on request.

This major new development in sewage treatment eliminates accumulated grease and slime. It also serves as a preventive measure against sulfide odor and corrosion damage.

George Lusk, Superintendent of Sewage Treatment Plant in Hollywood states: "The Cloroben Chemical Rotation Method controls grease and odors effectively and economically. We are saving much more on labor than the cost of the material used. This preventive maintenance program does more than save money and labor for us. It reduces to a minimum the distasteful job of sewer rodding and cleaning. As a result, we have cleared lines of grease and odors and killed all the insects, too."

Fred Funnell, Superintendent of Sewage Treatment, Fort Lauderdale, states: "The weekly cost of using Cloroben in a trouble area is $3.00. Application takes one man half an hour, as against our former procedure: a crew of four and a service truck tied up for two or three hours."

Reports from other sewage treatment superintendents confirm these amazing results achieved by the Cloroben Up-Sewer Chemical Rotation Method. Certainly it is worth your immediate consideration. Write or call today.


CLOROBEN CHEMICAL CORPORATION

THE CLOROBEN UP-SEWER CHEMICAL ROTATION METHOD

TECHNICAL BULLETIN AVAILABLE

Just prepared, this Technical Bulletin fully describes "THE CLOROBEN UP-SEWER CHEMICAL ROTATION METHOD". Complete with easy-to-follow instructions and illustrated with diagrams. Write for your free copy of this valuable new Bulletin today.

CLOROBEN CHEMICAL CORPORATION

115 Jacobus Avenue, South Kearny, New Jersey, Subsidiary of Standard Chlorine Chemical Co., Inc.

Chain Link Fencing of Alcoa Aluminum Now Available Throughout U.S. to Help You Cut Maintenance

Chain link fencing of Alcoa® Aluminum, for highways, divider strips and rights-of-way, is a bigger bargain than ever: the premium you pay for aluminum now amounts to *less* than the cost of one routine painting of ordinary metal fencing.

From this point on, you're money ahead with aluminum. This was proved recently by examination of an aluminum fence installation in Pittsburgh. Installed 30 years ago in a continuously corrosive atmosphere, it is still standing today and will probably live to be 100! The aluminum still has its original structural soundness and good looks . . . has never cost a penny in maintenance.

Long-life, trouble-free installations like this are typical, but check the many other exclusive advantages you get with fencing of Alcoa Aluminum:

- **High Strength**—Average tensile strength of Alcoa's new alloy is 57,500 lbs/sq in.
- **Easy Erection**—Light weight means it goes up faster with less labor.
- **Enduring Beauty**—Aluminum ages to a pleasing, soft gray; never corrodes or peels.
- **Readily Available**—Reliable manufacturers and erectors in all 48 states can supply Alcoa Aluminum fencing and accessories. For the name of the supplier in your area, contact your nearest Alcoa sales office.

Send for Complete Specifications!

Alcoa's A.I.A. File 14-K contains complete specifications and technical data. For your copy, write Aluminum Company of America, 2147-K Alcoa Building, Pittsburgh 19, Pa.

ALCOA ALUMINUM

Your Guide to the Best in Aluminum Value

"ALCOA THEATRE"
Exciting Adventure
Alternate Monday Evenings

HERE'S WHY COLCHESTER, N.Y., NOW HAS TWO D6s

Caterpillar D6 Tractor with No. 6A Bulldozer works on a one-mile road rebuilding job near Colchester, N. Y. Cat No. 955 Traxcavator is loading a truck in the background.

The town of Colchester, N. Y., recently bought its second Caterpillar D6 Tractor. The first is 10 years old. "Since we bought that D6," says Harry M. Shaw, superintendent, "we have had no down time except for normal replacement of worn parts. Our new D6 is just as rugged and we expect just as much of it."

The D6 has proven its power and versatility in thousands of municipalities. With 5 forward speeds and 4 reverse, the 93 HP D6 develops 19,000 lb. maximum drawbar pull. The long-lived oil clutch is standard equipment.

One feature of the D6 that is particularly popular is a simple hydraulic unit that takes the effort out of steering.

Your Caterpillar Dealer will be glad to demonstrate on your roads the track-type tractor that's right for your municipality. And his reliable parts and service stand back of your investment.

Caterpillar Tractor Co., Peoria, Illinois, U.S.A.

"Ten years of top performance from our D6," says Superintendent Harry M. Shaw. Town of Colchester now has two D6s in its 100 per cent Caterpillar team.

CATERPILLAR

Caterpillar, Cat and Traxcavator are Registered Trademarks of Caterpillar Tractor Co.

YOUR TAXPAYERS GET THEIR MONEY'S WORTH WITH CAT-BUILT MACHINES

COMPETITIVE BIDDING FOR PROFESSIONAL WORK SHOULD NOT BE TOLERATED

WILLIAM G. MURPHY,
Associate Professor and Director, Department of Engineering Mechanics, Marquette University

EVERY ENGINEER is undoubtedly practicing his profession in a manner which he believes to be ethical. This appears to be a certainty since no one can be heard proclaiming that he is conducting himself or his affairs in an unethical fashion. Therefore, the repeated violations of the Code must indicate that many engineers do not have a complete concept of the proper ethics for daily conduct of engineering affairs.

It is not enough to have accepted a code of ethics. Engineering will never become a respected profession unless every member of the profession takes it upon himself not only to practice according to a code embodying well established rules of conduct, but also to see that all with whom his practice causes him to associate conduct themselves accordingly. The contributions of any individual to civil engineering as a profession will be entirely negative without strict adherence to a code of ethics because failure to follow the Code hurts the public, the profession and the engineer.

For all to comply with a code of ethics requires complete understanding of it. Specifically at this time there appears to be a great deal of confusion on the topic of competitive bidding. Item No. 4 of the Code of Ethics of the American Society of Civil Engineers states that:

"It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers to invite proposals for the performance of professional engineering services or to state a price for such services in response to any such invitations when there are reasonable grounds for the belief that price will be the prime consideration in the selection of the engineer."

Perhaps a discussion of the factors involved in this statement will help toward understanding and thereby compliance. There are three parties to any code of ethics; namely, the client, the engineer (in this case) and the public. The interests of all three must be considered and competitive bidding is against the best interests of all three. Yet, many argue that competitive bidding is necessary to the conduct of an engineering practice on the grounds that engineering is not a profession, that the public should get the lowest price and that bidding is required by law. All of these arguments fail to put the best interests of the public foremost, a requirement of all professional thinking.

Moreover, competitive bidding is tantamount to assuming that all engineers who submit bids have equal ability, experience and training. Any reasonable engineer would deny this. The professional services of an engineer are creative and essentially unique such that no two engineers will ever be equally qualified.

Clearly the professional engineer should provide the best of his talents to each and every client and expect to be adequately recompensed for his services. Nevertheless, history has shown that whenever price is used as a consideration it quickly becomes the most important factor. The public is thereby deprived of any attempt to get the best services by the efforts to secure the cheapest. The very creativity which we value so highly makes it possible to prepare plans and specifications which will require less money, but only at the expense of the client.

However, we are not completely dependent on the above philosophical reasoning which has been evolved from the sum of engineering experience. There is complete legal basis for every thought expressed. The courts or the best in legal opinion have repeatedly held to the effect that engineering services are professional services and as such need not be procured by the process of competitive bidding. For example, the case of Clyde C. Kennedy vs. Harry D. Ross, Controller of the City and County of San Francisco (S.F. No. 17 298) resulted in an opinion that competitive bidding was not required in procuring expert service. Reference can also be made, as it was in the case of Stratton vs. Allegheny County (245 Pa. St 519—1914), to Dillon on *Municipal Corporations* section 1203: "Scientific knowledge or professional skill has also been regarded as furnishing an exception to the statutory rule. Thus, it has been said that the services of a lawyer, of a physician, or of an architect or a surveyor are not embraced within the provisions requiring the letting of contracts to the lowest bidder."

American Society *of* Civil Engineers

Code of Ethics

It shall be considered unprofessional and inconsistent with honorable and dignified bearing for any member of the American Society of Civil Engineers:

To act for his clients or for his employers in professional matters otherwise than as a faithful agent or trustee, or to accept any remuneration other than his stated charges for services rendered his clients.

To attempt to injure falsely or maliciously, directly or indirectly, the professional reputation, prospects, or business of another Engineer.

To attempt to supplant another Engineer after definite steps have been taken toward his employment.

To invite proposals for the performance of engineering services or to state a price for such services in response to any such invitation, when there are reasonable grounds for belief that price will be the prime consideration in the selection of the engineer.

To compete with another Engineer for employment on the basis of professional charges, by reducing his usual charges and in this manner attempting to underbid after being informed of the charges named by another.

To review the work of another Engineer for the same client, except with the knowledge or consent of such Engineer, or unless the connection of such Engineer with the work has been terminated.

To advertise in self-laudatory language, or in any other manner derogatory to the dignity of the Profession.

To use the advantages of a salaried position to compete unfairly with Engineers in private practice.

To use undue influence or offer commissions or otherwise to solicit professional work improperly, directly or indirectly.

To act in any manner or engage in any practice which will tend to bring discredit on the honor or dignity of the Engineering Profession.

March 1, 1956

Not only have the courts provided a legal basis for placing engineering services in the category of professional services, but the question of whether the public can expect the best use of its funds by competitive bidding was answered effectively by the Texas Supreme Court (Stephens vs. McCammon—1932; 52 SW sec 56). Briefly the court held that competitive bidding for professional services in effect places a premium on incompetency.

If this is not enough, we can note that the courts have based their opinions on the concept that bids are required only when a definite specification can be written to cover the material or service under consideration. Surely it is next to impossible to write a specification governing the quality or quantity of thought, creativity, mental skill or judgment required of an engineer in the design of a project. There is a well known truism that no two humans are alike. Need it be mentioned that engineers are human? Therefore, any bid for an engineering service is completely meaningless since there is no common basis for comparison with other bids.

Public Money is Being Spent

In spite of all this argument against competitive bidding, there remains the fact that public money is being spent for some of the professional services considered here. The public deserves some safeguard to insure proper stewardship in the expenditure of public funds. Competitive bidding is not the answer to this problem unless it is assumed that our public servants are totally ignorant. This assumption is so obviously false that there is no need for discussion. But, since it is false, there is no need for competitive bidding.

The American Society of Civil Engineers has taken these factors into consideration when they, speaking as a body of practicing engineers, recommend that professional services be secured by negotiated contracts. It is significant that most of the biggest and best public works organizations now obtain their professional services in this manner, including the Defense Department, the Atomic Energy Commission, the Bureau of Reclamation and several of the major municipalities.

This procedure can be found in the ASCE Manual of Professional Practice, Manual No. 29, and the essential features are quoted below:

1) From a list of engineers recommended by qualified sources such as other employers or engineering societies, select one or more engineers to be interviewed; 2) Determine which one of the engineers interviewed is the best qualified for the particular engagement under consideration; 3) Negotiate with the engineers so selected for services of the nature and extent required; 4) The reasonablesness of fees to be charged may be checked with the sources of the lists under No. 1 above; and 5) Engagements involving preliminary investigation and reports should commit the engineer to limiting fees in case additional services are required at a later date on the same project.

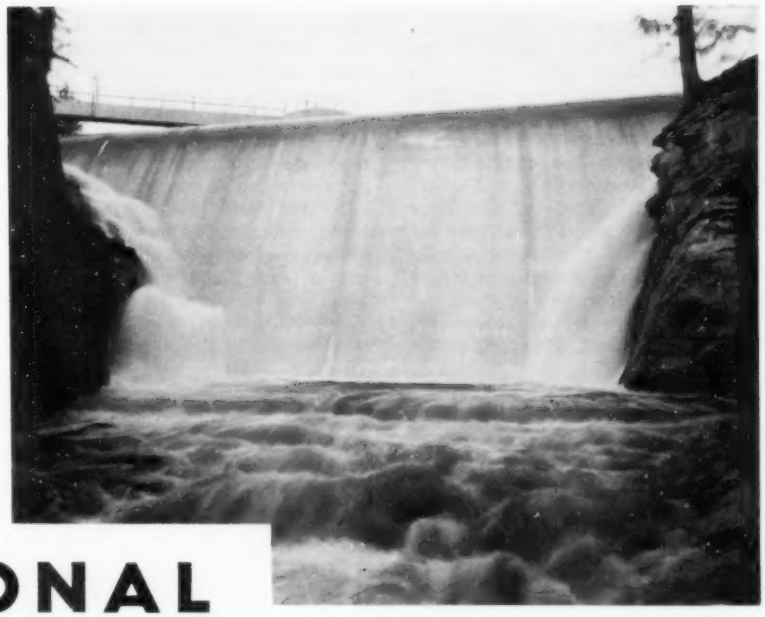
It should be noted that it is the spirit of the above that, should negotiations with the first engineer selected be terminated for any reason, another engineer from the list is to be chosen for further negotiation. This process continues until a contract satisfactory to all parties has been negotiated.

In the public interest and for professional advancement, collectively and individually, competitive bidding should no longer be tolerated. The professional way of obtaining contracts is by negotiation.

References

Carey, William N., "Competitive bidding for professional services not in the public interest." *Civil Engineering*, Vol. 24, p. 297, May 1954.

Editor's Note: This article has been directed primarily to engineers but public works officials can learn much by reading it. Their responsibility in engaging a consultant is to obtain maximum values from the structures which he is to design and construct. Obviously a wise selection of engineering skills is necessary. This responsibility should not be jeopardized by selection on a price basis; rather the sole criterion in selecting the engineer should be the values he can contribute to the community.



● FLOOD flow over Hammonassett Dam in Dec., 1957. Flow line is 50 ft. over stream bed elevation. Dam is 180 feet long; has an ogee type spillway.

ADDITIONAL *Water Supply for The New Haven Area*

ERNEST W. WHITLOCK
and
ROBERT D. MITCHELL,
Partners, Malcolm Pirnie Engineers,
New York, N. Y.

THE WATER supply system of the New Haven Water Company which serves the New Haven area is one of the largest in the State of Connecticut. It extends from the Housatonic River eastward 31 miles along Long Island Sound to Guilford and northward about 20 miles to Southington. The system furnished in 1957, an average daily draft of 44 million gallons to over 300,000 people in 12 separate communities.

The supply is from streams having a total drainage area of 117 square miles which flow into 16 reservoirs. The topography is such that a number of pumping stations, distribution system storage reservoirs and tanks are required to provide adequate pressures in various parts of the system. About 80 percent of the water is from sparsely inhabited upland drainage areas which discharge into well-protected storage reservoirs.

The history of the New Haven Water Company covers a period of more than a century. In 1849, when the population of New Haven was about 20,000, a group of citizens, realizing that public and backyard pumps did not provide adequate water supply and fire protection service, organized the New Haven Water Company and secured a charter from the Legislature.

In July, 1859, they entered into a contract for $350,000 with Eli Whitney, son of the inventor, and Charles McClallan and Son, Contractors, for acquisition of land and construction of the works. They chose the present dam site on Lake Whitney as a site for the supply. Early settlers had constructed a low dam and operated a grist mill at this site and in 1798, Eli Whitney bought the site and erected the Whitneyville Armory, then the largest gun factory in the United States. It was here that mass production of interchangeable parts was originated and first practiced by Mr. Whitney. He also pioneered in construction of company housing for his employees.

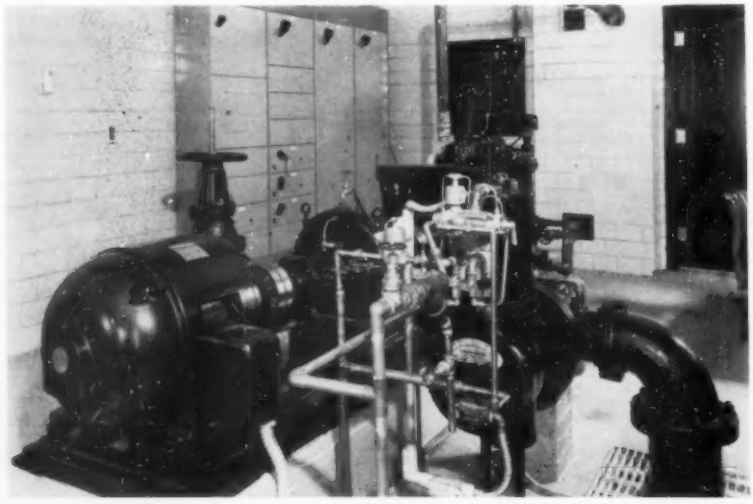
The original water supply project was completed and put into operation in 1862. It consisted of a stone and concrete masonry dam 30 feet high and 500 feet long which backed up Mill River 2½ miles to form Lake Whitney; a pumping station with pumps operated by two 30-ft. diameter water wheels discharged through a 15-in. cast iron main to a 10-million gallon reservoir on Sachem's Hill; and 18 miles of mains extending into the City. The pumping facilities were regarded as a major engineering feat of the day.

While construction was in progress others became interested in supplying water to the City. The Mountain Water Company attempted to provide a supply for the western part of the City from the streams in Maltby Park; and the Fair Haven Water Company investigated Lake Saltonstall and Farm River as source of supply for the eastern section known as Fair Haven.

The Fair Haven Water Company purchased the rights of the Mountain group and constructed Maltby Reservoir No. 1, Maltby Reservoir No. 2 and Wintergreen Reservoir in 1862 and 1863. However, they were unable to obtain rights to extend their mains across New Haven,

which was prohibited by terms of their original charter. Meantime, the New Haven Water Company extended its mains into Fair Haven and in 1875, it purchased the rights and supplies of the Fair Haven Water Company.

The Company has operated for many years continuously as a single unit under the name of the New Haven Water Company, whose system is integrated with its wholly owned subsidiary, the Milford Water Company. Besides New Haven, the system now serves Branford, North Branford, Cheshire, Hamden, North Haven, Orange, West Haven, East Haven, Milford and parts of Woodbridge and Bethany.



● **RABBIT ROCK booster station serves a high elevation area. Ground elevations in the area served vary from 0 to 300 ft., requiring pumping and other provisions.**

Although the original developers believed that Lake Whitney would furnish the perpetual water needs of the New Haven area, it was soon necessary to turn elsewhere for additional water. Practically all other suitable nearby local sources were acquired and utilized to capacity by 1920.

At that time the Company turned its attention easterly toward undeveloped drainage areas beyond the Farm River. Investigations and studies resulted in the decision to construct the North Branford Development, one of the largest water supply projects in the state of Connecticut. Over the next several years lands and rights-of-way needed for this development were purchased, and plans for the first stage of construction were prepared and those for the second stage, to be constructed 25 years later, were given preliminary study at the same time.

The Company's present sources of supply consist of 9 systems of dams and reservoirs which collect and store water from drainage areas totaling 117 square miles. The Company owns 25,000 acres of reservoir and protective forest land. Natural drainage into these reservoirs is supplemented in many instances by extensive diversion projects. The transmission mains from the supply system are interconnected to provide unified and flexible group operation. This increases the overall safe yield above that obtainable from the supplies operated individually and assures reliability for all parts of the system at all times.

Lake Whitney is still one of the important supplies because its large tributary drainage area contains substantial deposits of sand and gravel which provide ground water storage contributing to its comparatively high yield in dry weather. Water is filtered and pumped from it to the nearby Prospect Hill, Mill Rock, Country Club and Ridge Road high service areas and also to low service areas through connections to the Mill Rock Twin distribution reservoirs.

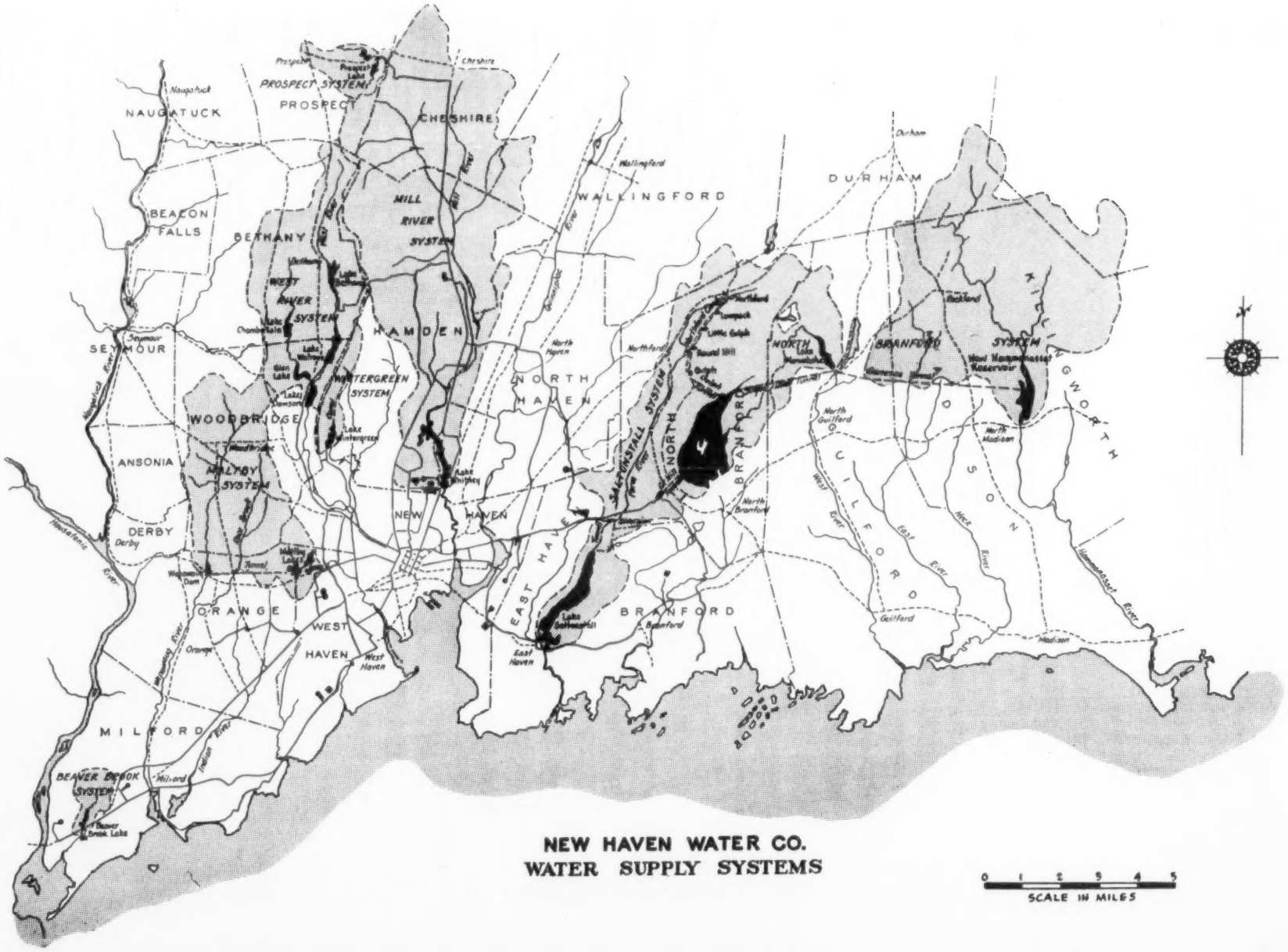
The other principal pumped supply is Lake Saltonstall. This is a natural lake which has been raised to provide additional storage. It is supplied by its own drainage area of about 3 square miles plus about 11 square miles of drainage area on the Farm River which is diverted to Lake Saltonstall by means of a tunnel 3,000 feet long.

Lake Wintergreen, four miles northwest of New Haven, provides a high service supply to areas in the western part of the City. Prospect Lake, the most distant supply from the City, provides the main supply for Cheshire which is a high service area. Lake Bethany, one of the five reservoirs in the Woodbridge group, is also a high service reservoir. It supplies part of Cheshire and high service areas in Hamden and the Ridge Road area of New Haven. The Company also owns and operates a number of small reservoirs. These serve areas which are for the most part outside the City.

The three Maltby Lakes were the first to be developed to augment the original Lake Whitney supply. Water is pumped from them to high service areas in West Haven, Orange, and Milford. Maltby Reservoir No. 2 also supplies water by gravity to lower elevations in New Haven. In 1908 a dam and diversion tunnel were constructed to divert water from the Wepawaug River into the Maltby group.

Three of the reservoirs of the Woodbridge group, Lakes Watrous, Glen and Chamberlain, feed into the low service system and a fourth, Lake Dawson, is held in reserve. Also held in reserve is the Branford Reservoir which originally served the Branford area.

The latest and largest water supply development of the Company was the North Branford Development. It was first conceived in the early twenties to provide the collecting and storage facilities required to meet increasing demands over the next 50 years. Construction was divided into two stages approximately 25 years apart. The first stage, known as the Lake Gaillard Project, was completed in 1932. It consisted of the Lake Gaillard Dam and Reservoir, Menunkatuc Dam and Reservoir, Sugar Loaf Tunnel 3 miles in length to divert the Menunkatuc supply into Lake Gaillard; Gulph Tunnel to divert a part of Farm River runoff into Lake Gaillard; Great Hill Tunnel to serve as the outlet from Lake Gaillard, and a 48-in. supply main into New Haven, together with a connecting 36-in. supply main installed just outside of the business center of New Haven which effectively interconnected the Lake Gaillard Supply with other supply systems to the north, east and west of New Haven. Lake Gaillard provided a 16-billion gallon capacity reservoir covering 1,105 acres. Watershed directly tributary to it was only 7 sq. miles and it was necessary to divert other watersheds into it in order to make effective use of this large storage capacity. The first stage provided


NAUGATUCK
PROSPECT
CHESHIRE
BEACON FALLS
BETHANY
MILL RIVER SYSTEM
WALLINGFORD
DURHAM
WEST RIVER SYSTEM
SEYMOUR
HAMDEN
WINTERGREEN SYSTEM
NORTH HAVEN
WOODBRIDGE
ANSONIA
MALTBY SYSTEM
DERBY
NEW HAVEN
EAST HAVEN
BRANFORD
ORANGE
WEST HAVEN
MILFORD
BEAVER BROOK SYSTEM
NORTH BRANFORD SYSTEM
NORTH BRANFORD
NORTH GUILFORD
GUILFORD
MADISON
BRANFORD SYSTEM
NORTH MADISON
NEW HAVEN WATER CO.
WATER SUPPLY SYSTEMS
SCALE IN MILES

some of these diversions and the balance were provided in the second stage.

The second stage, known as the Hammonassett Project, was completed in 1957. It consisted of the Hammonassett Dam and Reservoir; diversion works on Iron Works Stream and Little Meadow Brook; the 4 mile Genesee Tunnel; and the 54-in. Quonnipaug Pipe Line.

Upon completion of the first stage in 1932, the safe daily yield of the Company's systems in a 95 percent dry year was 37 million gallons, computed on the basis of each reservoir operated separately. However, the system is so interconnected that additional yield may be obtained by selected withdrawals from each reservoir. We estimate that the safe yield on a group operation basis was at least 40 million gallons per day in a 95 percent dry year.

Upon completion of the second stage in 1957, the estimated yield for the entire system, on an individual basis, is 55 million gallons per day. We estimate that, operated as a group, the system will yield at least 60 million gallons per day in a 95 percent dry year. The above estimates of yield are computed on the basis of a drawdown in Lake Gaillard to Elevation 170.0, the lowest elevation to which the reservoir can be drawn by gravity. However, total yield can be increased to approximately 70 million gallons per day by installing low lift pumps at Lake Gaillard to increase the usable storage. Additional diversions from the East Branch of the Hammonassett and two smaller areas will increase the total yield to about 75 mgd.

Distribution System Facilities

Water is transported from the reservoirs to the homes and businesses of the communities served by means of almost 1,000 miles of 48-in. diameter and smaller pipe. A 48-inch main extends from Lake Gaillard to the City where it connects to other transmission mains from pumped and gravity low service supplies and to the Mill Rock Twin balancing or equalizing reservoirs whose flow line is Elevation 165. This low service system supplies a large portion of the total water which is consumed. In recent years the high service areas, most of which are located in the outskirts of the City, have grown rapidly. Besides the high service reservoirs previously described, these are served by nine storage tanks and pumping stations.

The property is well operated and maintained by experienced and well-equipped crews. Gate valves are located at frequent intervals with 3 valves at each intersection to permit ready repair of pipe in case of breaks. A large stock of pipe, appurtenances and equipment parts are available for immediate replacement and repairs. A radio-telephone communication system has been installed in the cars and repair trucks of the company to aid in obtaining immediate action in case of emergency.

Records are complete and are kept up to date. They include general and sectional maps of the distribution system; maps of supply works and plans of pumping stations; card index records of valves and hydrants; and monthly and annual reports on all phases of operation.

Water Consumption

In 1957, the average daily draft from the New Haven reservoirs was 44.42 million gallons and an added 1.26 mgd were supplied by the Milford Reservoir. During the past 10 years the maximum month has averaged about 112 percent of the average but has been as much as 128 percent of the average. Peak days average about 150 percent of yearly average. No good record of the peak hour is available but the peak delivery from primary sources was at a rate of about 90 mgd. The per capita use has been climbing steadily. In 1940, it was about 110 gallons per day. By 1950, it had increased to 132 gallons per day, and in 1957, it was estimated to be about 143 gallons per day.

Because of the importance of satisfactory water quality at all times, the Water Company maintains careful sanitary control over its watersheds, reservoirs and treatment facilities. These controls are verified daily by chemical and bacterial analyses of water samples taken from the distribution system. A well-equipped laboratory is maintained at the Lake Whitney filter plant and water from the reservoirs and distribution system is being constantly tested to be sure that it meets all requirements.

Lake Whitney water is filtered through four acres of slow sand filters before being pumped into the system. All waters furnished by the Company are chlorinated by means of 9 chlorinating stations located on the various supply sources. All of these installations are automatic; that is, chlorine is introduced in proportion to the flow. The Company generally uses electrically operated centrifugal booster pumps to furnish pressure water to the chlorinators. In most cases a set of hydraulically operated pumps is in automatic standby and come into operation immediately on power failure. Where conditions are favorable, hydraulic pumps are used alone, but the Company has found it more economical, because of reduced maintenance, to use the electric motor-driven centrifugal pumps.

Distribution Problems

Ground elevations in the areas served vary from sea level to over 300 feet, while reservoir elevations vary from 19 to 427 feet above sea level, with several reservoirs at different elevations serving the same pressure area. These differences are compensated for by pumping, use of pressure regulating valves and, in some instances, by the effects of system resistance.

Gradual changes are taking place in operating conditions in the system. Areas too high for service under existing conditions are being opened for development and when enough customers are in prospect, a new high service area must be created. It is often impracticable and uneconomical to provide adequate service to certain remote consumers on high ground, particularly during periods of extreme peak demands. This situation has been aggravated during the past two or three summers by extremely hot dry weather and by excessive use of water for sprinkling during hours of peak domestic consumption. At a few times it has been advisable to restrict sprinkling during peak hours.

Supply of the summer cottages that exist on the shoreline of Long Island Sound in the New Haven area is another difficult service problem. Many of the cottages are served by pipe laid on or near the ground surface. These pipes must be drained each autumn to prevent freezing. The Company has about 12 miles of such lines serving about 2,000 customers in summer. Trends toward all-season occupancy and increased consumption are gradually requiring a replacement program.

The work described previously and completed in 1957 provides full tunnel capacity for the ultimate development. The required diversion capacity of about 150 mgd is furnished by the unlined sections of the Genesee tunnel. The lined section provides a capacity of about 200 mgd. The finished tunnel has a capacity somewhat in excess of the design figure, but since the tunnel size is about the economical minimum, nothing would have been gained by decreasing the size.

Because of poor rock conditions, it was believed advisable to avoid tun-

nel work across the Quonnipaug Valley. A pipe line was investigated for this 4,000-ft. section. It was found that one 72-in. pipe line, or two 54-in. pipe lines, would be required for the ultimate diversion, but that one 54-in. line would be adequate for the first stage of the development. Therefore, one was installed with provisions for construction of the second pipe when additional diversions are made.

Original planning for the project under Stage 1 called for a grade tunnel, and the Sugar Loaf Tunnel and Lake Menunkatuc Dam were constructed on that basis. When Stage 2 plans for the extension to the Hammonassett were started, it appeared that it would be advisable to depress the tunnel in order to insure reasonably good rock conditions, particularly under the valleys of streams that cross the tunnel alinement. After borings were made it was decided best to avoid tunnel work in the fault zone by crossing the valley with the pipe line.

Future diversions to bring the system to its ultimate capacity include pumping from Page Lot Brook and a brook in North Madison; and gravity diversions from the East Branch of the Hammonassett River and Cedar Swamp. The initial work diverts flow from about 23 square miles of watershed. Additional diversions proposed for the future will increase this area to about 32 square miles.

Hammonassett Dam is located at Nineveh Falls about 400 feet north of Route 80 where the Hammonassett River has cut a notch through an igneous rock formation. The notch at its narrowest point is at present about 120 feet wide at flow line elevation. The flow line is about 50 feet above stream bed elevation at this point. The dam is located slightly upstream to increase stability and permit a longer spillway. It is about 180 feet long at flow line elevation. Of this length, 163 feet is an ogee type overflow spillway. At its maximum section, the dam rises about 70 feet above its rock foundation. Abutments to the west and a concrete dike section some 235 feet long to the east provide a freeboard of 7 feet. Water may be released downstream by means of a gate chamber and a 36-in. pipe through the dam.

The reservoir when full contains approximately 1 billion gallons of usable storage. The tunnel inlet is located on an arm of the reservoir a little more than one mile in a northerly direction from the dam. It consists of a heavy concrete box structure. Water enters through 4 sluice gates, each 4 feet square, and passes through coarse racks into a transition section, which in turn connects to the easterly end of the tunnel. The gates are equipped with motor-driven operators and the rack has a power-operated Leonard type rake.

Because of the isolated location, a gas engine generator set was installed to operate the gates and rake. From the intake the tunnel runs at a downgrade of about 0.88 percent for 13,480 feet to the working shaft. From this point it proceeds for another 8,036 feet on a rising grade to another shaft into which is built a transition section terminating in two 54-in. outlets, one of which is temporarily blanked off.

The Genesee tunnel is horseshoe-shaped, with a nominal height of 8 feet 6 inches and a width of 8 feet 2 inches; it involved the removal of about 2.83 cubic yards of rock per foot. Sections that required lining have a finished horseshoe shape 7 feet 6 inches high and 7 feet 2 inches wide, except at transition sections.

The pipe line, 54 inches in diameter and 3,750 feet long, is a cast reinforced concrete steel-cylinder pipe manufactured by Lock Joint Pipe Company. About 125 feet east of the connection to the tunnel built in Stage 1 is located a 54-in. by 38½-in. Venturi tube meter and meter house. The connection to this tunnel is by a transition section built into the tunnel and terminating in two 54-in. outlets, one of which is blanked off.

The Little Meadow Brook diversion consists of a low weir across the brook with a diversion structure consisting of a narrow channel, a bar rack and an 18-in. pipe outlet. The outlet connects to the tunnel through about 80 ft. of pipe and an 18-in. downpipe 90 ft. long into the tunnel. The downpipe was originally planned to be drilled as a bore hole together with two other similar holes. The contractor elected to install them by open shaft methods.

The diversion at Iron Works Stream was made about 2,900 ft. north of the tunnel in order to permit a gravity diversion. It consists of a mass concrete ogee spillway section 110 ft. long. The spillway crest is approximately 9 ft. above the existing stream bed and the masonry section will extend several feet below the stream bed to sound rock.

The intake structure is built into one abutment section and diverts water into a 36-in. diameter Lock Joint prestressed reinforced concrete pipe 2,800 ft. long, which discharges into a 36-in. downpipe 120 ft. long connecting into the tunnel.

The third downpipe mentioned previously is about 2,500 feet east of the working shaft. It has a finished diameter of 18 inches and will be used for future diversion from Cedar Swamp.

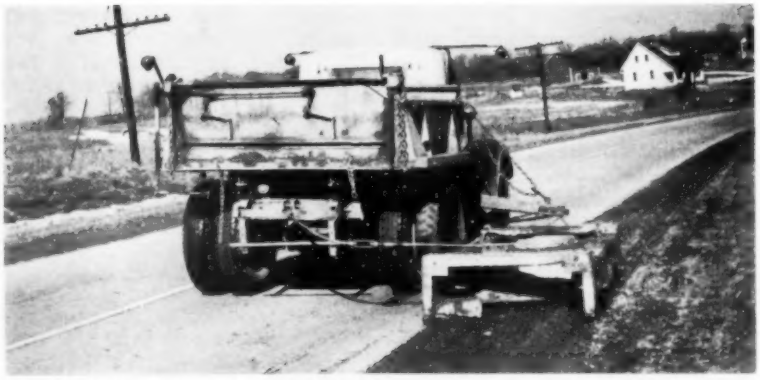
Administrative duties of the New Haven Water Company are performed by G. Y. Gaillard, Chairman of the Board of Directors and Arthur L. Corbin, Jr., President of the Company. Frank J. Callahan is general manager and Joseph A. Novaro is chief engineer.

A. B. Hill and Blair & Marchant, Inc., were consulting engineers on the first stage of the North Branford development. The second stage additions were planned and designed by Malcolm Pirnie Engineers and that firm furnished general supervision of construction with A. William Douglas as its resident engineer. Clarence Blair Associates of New Haven provided all of the survey work for the project and the forces necessary for detailed inspection and supervision.

● DRIVING the Genessee Tunnel. This is horseshoe shaped, 8.5 ft. high and 8.17 ft. wide, involving removal of 2.83 cu. yds. of rock per foot. Portions are unlined.

SHOULDER MAINTENANCE PRACTICES

J. W. REPPEL,
Engineer of Maintenance,
Ohio Department of Highways



● **SHOULDER drag in operation. In Ohio, shoulders vary from traffic-bound and grass cultivated to stabilized aggregate, surface treatments and penetration macadam. All require maintenance to reduce damage to roadways and promote safety.**

SHOULDER construction and maintenance is becoming increasingly important on today's highways. New construction at this time provides adequate shoulder facilities and maintenance of these installations necessitates comparatively small expenditures in comparison to requirements on existing narrow pavements with inadequate shoulders and ever increasing traffic. Ohio's shoulder types vary from traffic-bound, and grass cultivated, to stabilized aggregate, surface treatments, and finally penetration macadam with surface seals.

The highway shoulder, or berm, is that portion of the roadway between the pavement edge and the ditch or fill slope. Its function is essentially that of safety, to furnish an unobstructed space between the driving surface and the ditch or fill hazard, and to provide extra driving width when needed. As a part of the highway structure, it provides a horizontal foundation to support and protect the pavement edge, and conducts surface water away from the road surface. Shoulders now being constructed include stabilized, grassed, and penetration types, and maintenance efforts are directed always to their preservation and betterment to assure protection to both the highway user and the highway facility.

Large mileages of narrow pavements, with increasingly high traffic densities, have made effective berm maintenance extremely difficult. A berm should be smooth and flush with the pavement edge, preferably waterproof, stable enough to support traffic when necessary, and uniformly sloped to provide quick run-off for pavement surface water. If one or more of these conditions are lacking, we build up traffic hazards and encourage water damage. A high berm ponds water along the pavement edge, saturates the subgrade, and weakens the surface at that point; a condition of this nature further induces additional hazard and damage by freezing and thawing. A low berm is definitely a traffic hazard, and any irregularity adjacent to the pavement is a constant menace to every vehicle.

Shoulders of uneven contour or insufficient slope, or those which have shrinkage cracks along the pavement edge, cannot function satisfactorily and a primary maintenance objective is to keep the pavement edge sealed and prevent water infiltration at that point. Water tends to concentrate immediately adjacent to the pavement edge, and a small shoulder rut may be formed. This small rut, if permitted to remain unmaintained, gradually increases in size, holds more water, and undercuts and weakens the adjacent pavement edge; on grades this condition can create a bad traffic hazard because of its depth, and at low grade points, this water usually finds its way onto the road surface, where it contributes its share to pavement and subgrade instability.

Improper shoulder blading or dragging oftentimes creates false ditches; this condition can be observed on berm edges in cuts, but is particularly noticeable along guard rail on fills. Maintenance personnel should always be cognizant of the fact that two ditches are unnecessary in cut sections, and certainly that ditches on shoulders in fill sections are undesirable. The berm slope should be uniform and steeper than the road gradient to prevent surface water concentration, and consequent scour, along the pavement edge. Snow removal operations are not complete until the snow is pushed away from the pavement across the berm to the ditch or fill slope. This provides space for subsequent snow storage, and eliminates the hazard and damage caused by melted snow traversing the pavement surface.

Narrow Pavements

Ohio has many miles of narrow pavements with trafficbound shoulders and work on this type consists principally of the provision of proper slopes to eliminate high or low places, and adding aggregate and dragging or blading with a maintainer at regular intervals to keep material flush with the pavement. Traffic bound shoulders should generally be dragged or bladed as traffic dictates; most shoulders should be reshaped after rains when moisture conditions permit proper manipulation. High traffic roads usually require more frequent attention, as most heavy vehicles appear to ride the pavement edge.

Material should be added as needed. top size should preferably not exceed ¾-in., as larger sizes are whipped off by fast traffic. Addition of chloride or bituminous material to eliminate unsatisfactory dust conditions and consolidate existing aggregate is occasionally necessary.

Most new jobs a few years back, and some today, were constructed with grassed shoulders; this kind of construction requires a different approach than normal trafficbound or surface treated berm maintenance. Grassed shoulders often build up to form a reservoir to hold water and damage the pavement edge, and tend to become scarred or rutted by passing or parked vehicles. It is believed that shoulders to be seeded should be built from 1 in. to 1½ ins. below the pavement edge, and that shoulder material should contain proper combinations of aggregate and binder soil to furnish stability for an occasional vehicle load. Grassed shoulders should be maintained by patching out ruts and bad spots, leveling and compacting with light rollers as moisture conditions permit, and by normal mowing and routine clean ups. High berms that are definitely causing pavement damage or creating a traffic hazard should be cut down and reseeded, or permitted to reseed themselves if not cut too low. This type of shoulder has caused considerable discussion, but it is believed that properly built turf shoulders are acceptable and reduce maintenance costs at specific locations.

● **BITUMINOUS surface treated shoulder on an Ohio highway. This construction affords good drainage of storm water and permits safe use of shoulder by motorists.**

● **HIGH shoulders have been removed to permit proper drainage. High berms pond water, saturating subgrade. Additional hazards are created by freezing and thawing.**

Shoulder surface treatments, unless placed on a structurally sound base, inevitably break up and require excessive patching expenditures or too frequent retreatments. This type of construction, however, if placed on a good base, seals and waterproofs the pavement edge and more than justifies its original investment. A widened strip of 18 ins. to 24 ins. requires less base preparation and is easier to maintain than one having more width, due to the fact that greater widths permit travel of both tires on dual wheels which places greater loads on the widening. In this connection, it is desirable to use cover material that presents a color contrast to the existing pavement; this tends to keep traffic on the road surface.

Shoulder stabilization work in Ohio is generally completed by State forces. This operation consists normally of scarifying, pulverizing, incorporating chloride or cement and additional aggregate and water, mixing, compacting, reshaping and adjusting to the desired cross section, followed by application of a prime and seal coat. The prime consists of about 1/3 gallon per sq. yd. of liquid bituminous material with about 10 pounds of ½-in. top size chip cover. The seal consists of about 0.3 gal. per sq. yd. of heavy bituminous material and 20 to 25 pounds of cover aggregate. Satisfactory results have been obtained by bituminous penetration of 2 to 4 ins. of aggregate and a surface seal; high traffic locations occasionally require placement of cold or hot plant mix bituminous concrete shoulders. Maintenance of these types consists of routine base repairs and surface patching, spot sealing, etc., as required.

It is interesting to note the trend toward all weather shoulder type construction in recent years. The traffic bound type is still predominant, but it is being replaced gradually with bituminous types on stabilized bases. At the risk of being too repetitious, I should like to reiterate the basic necessity of the uniform continuation of the water gradient across the shoulder, and in this connection, it should not be considered a digression to mention the roadside ditch, which is so often neglected. Good ditches are a highway "must," and the importance of their proper upkeep cannot be overemphasized. The old superintendent who continually admonished his men to "show me a good ditch and I'll show you a good road" certainly expressed a basic maintenance concept, and self-draining shoulders and free flowing ditches constitute an unbeatable combination today as well as yesterday.

ROBOTRY in WATER and SEWAGE WORKS OPERATION

What you should know about the control of hydraulic and process variables

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PUBLIC WORKS Magazine

TWENTY YEARS ago, a water plant operator, upon observing that the level of the clear well had dropped, would call the operator of the low lift pump station and ask him to put another pump on the line. That, in a sense, is remote control, but the inefficiency of the system seems ridiculous in terms of present methods. Expensive human effort can be diverted to more productive functions than waiting for a telephone to ring or keeping an eye on the level gauge of a clearwell. Usually, no matter how remotely separated the two points might be, such an operation today is completely automatic, involving no human effort except to observe its operation and to provide for the maintenance of the system.

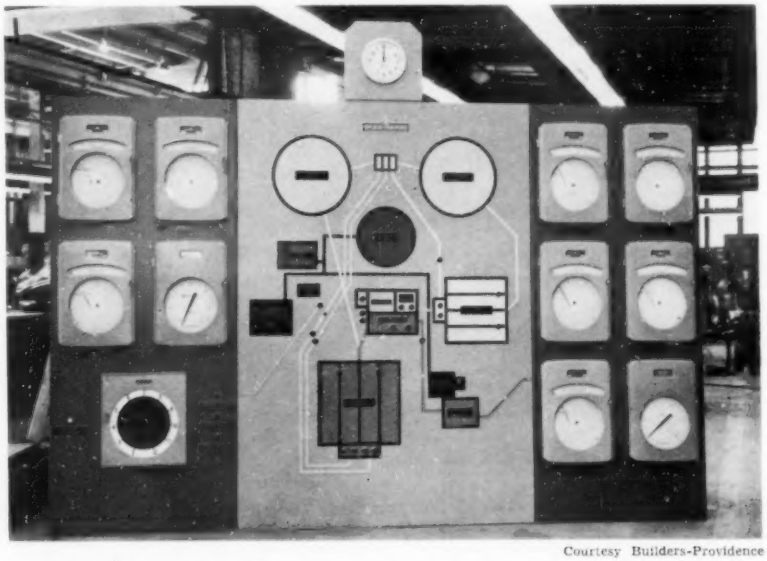
The designing engineer and the operating official in using an available water source and collecting and treating liquid waste are continually faced with factors which vary in time, quantity and quality. These are naturally occurring variables which are not easily subject to control, but they can be met by controlling the pumps, valves, and treatment devices. Instrumentation and remote operation provisions, when judiciously applied are aids to attainment of the objectives of water and sewage works operation. The techniques of applying process controls have attained a stage of development such that almost any function can be fulfilled by harnessing electromechanical devices which follow basic patterns of behavior. A number of the functions or phases of operation are frequently made completely automatic in modern designs. The instance of clear well level and raw water pump control is one example. Others are control of elevated tank water level, control of lift station pumping by the rate of inflow of sewage, and control of chemical dosage by variation in flow or pH of the raw water. Integration of these several automatic functions into a smooth working unit becomes more complicated with the magnitude of the operation, so that a "push button" or completely automated water or sewerage system of any appreciable size is still a dream of the future. Many controls may be applied, however, which are economically justifiable and which have been proved to be reliable.

Forms of Telemetering

Remote control of a function usually involves telemetering. By definition, a telemeter is the complete measuring, transmitting and receiving apparatus for indicating, recording or integrating, at a distance, the value of a quantity.

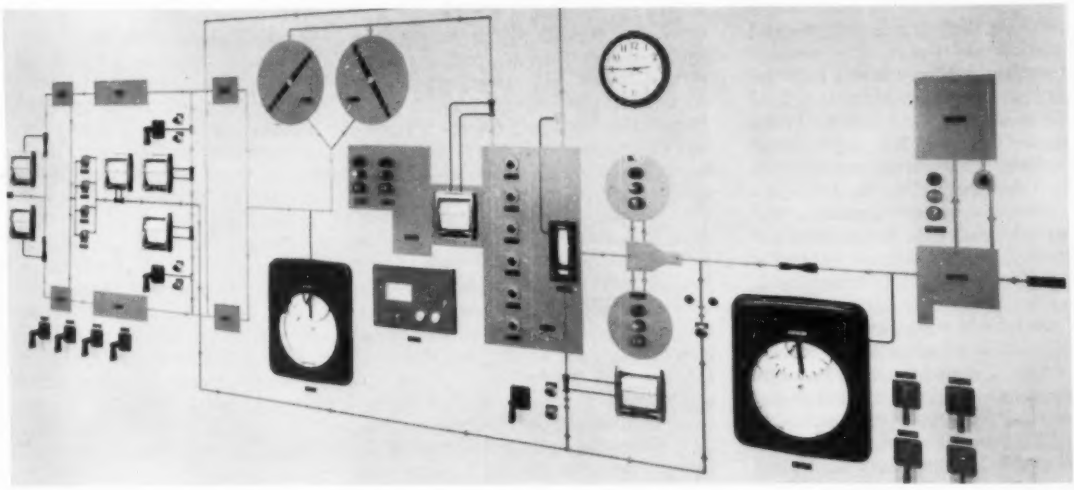
The three types of telemetering most used in the public utility fields today are electric, pneumatic and electronic. Many modern plants may employ all three methods, depending on the locations of the equipment. In the first, transmission is by electrical circuits. Pneumatic telemetering uses air pressure as the transmitting medium. An electronic telemeter may employ all electrical means including radio circuits and related equipment. Multifrequency circuits may be included in the overall picture of telemetering in a modern water or sewage plant.

Electric Telemetering. A telemetering system uses a sensing device, a transmitter and a receiver.



Courtesy Builders-Providence

● **TELEMETERING is used for instrumentation in this graphic panel, Fairfax, Va.**



Application of the graphic control panel is illustrated by this installation at the Durham, N. C., sewage treatment plant. The panel background is silver gray; the graphic representation of plant units is by means of medium gray shaded areas; the sewage flow circuit is in green; and the sludge flow lines are orange. The influent is shown entering the screen house at the extreme right, with overflow during storms bypassed to a holding tank shown above the screen house. The influent pH is indicated by the circular chart recorder; influent flow is measured by a primary device illustrated as a venturi tube and the flow is indicated on a chart recorder not shown. Two Vacuators are shown above and below a diversion structure, from which the sewage flows to a wet well, where level is indicated by a ribbon type indicator-receiver. Six low lift pumps, represented both graphically and by on-off lights are to the left of the ribbon recorder. The extension of the shaded area represents the central control building with a superimposed strip chart receiver-recorder for pumpage to the trickling filters and indicators for power failure. The trickling filter effluent pH is indicated by the circular chart recorder, before the flow is divided into two parallel intermediate settling tanks. Immediately to the right of the circular chart recorder is an amplifier for pH measurement. From each intermediate settling tank sewage flows to an aeration tank and final clarifier, with the flow measurement shown by the two strip chart recorders at the extreme left. Four return sludge pumps may transfer sludge from the final clarifiers to either of the aeration tanks, to the wet well or ahead of the Vacuators. A strip chart recorder immediately to the right of the pump battery indicates total return sludge; two others, the amount returned to each aeration tank; and a third, just under the Vacuators, the amount returned to the influent wet well. Valve controls (black rectangles with handles) are for adjusting return sludge to each point. The four control handles at the left side of the panel and the four on the right are used for the sludge pumps and the low lift pumps, respectively. All valves are electrically controlled from the panel; their positions are indicated continually and all measurements are recorded and indicated for the operator's observation at a glance. Aside from providing a convenient mounting arrangement for the controls and instruments, the graphic panel has an advantage from a public relations point of view, providing a dynamic diagrammatic layout for explaining plant operation to visitors. The strip chart recorders and ribbon type indicator receivers are particularly adaptable to use with graphic control panels because of their small size. The rectilinear case instruments or circular chart recorders have certain advantageous applications and can be combined with the graphic type instruments as shown here. *Photo courtesy Foxboro.*

The sensing element provides a means of measuring the value of a quantity, such as the rate of flow in a pipe. The transmitter translates this value into a signal and "sends" it to the receiver, where the signal is translated or decoded back to the original quantity which is indicated or recorded. In electric telemetering, the signal may take the form of a "pulse." This is an on-and-off signal which may vary in frequency (the number of impluses in a given time interval), which behavior is termed the "pulse rate" or "pulse frequency" method. Here, of course, the pulse rate is proportional to the quantity measured, e. g., the greater the flow in a pipe, the faster the impulse. In another method, the impulse may vary in duration, the length of time the impulse is "on." These impulses are part of a cycle of definite or fixed interval, such as 10 or 15 seconds and are of a duration proportional to the quantity measured. In a third method of electric telemetering, the signal is in the form of a varying voltage induced by a conductor passing through an electromagnetic field, the magnitude of the voltage being proportional to the value of the quantity measured. Instead of using an induced voltage, the electrical transmission may involve a directly measured voltage or current such as by means of electrodes.

Pneumatic Telemetering. In a pneumatic telemetering circuit, the transmitter and receiver are connected by small diameter tubing containing clean, dry air under pressure. The signal transmitted from the sensing device becomes increments of air pressure, the value measured corresponding to a definite pressure. The Instrument Society of America has established a standard range of 3 to 15 psi to be used by instrument manufacturers. The measured value is translated into air pressure of a magnitude between these limits, proportional to the range. In other words a minimum differential would be represented by air pressure of 3 psi and a maximum by 15 psi. Pneumatic transmission has its greatest field of application in within-plant systems.

Electronic Telemetering. This involves the use of electron tubes or transistors in amplifying signals, in

generation of signals as audio tones, or in transmission of microwave signals. Possibly its most general application in water and sewage works telemetering systems is in the form of generating, transmitting, and receiving signals as tones in audio frequency ranges. By the use of audio frequencies, transmission may be by telephone wires. In this system, the transmitter converts the measured value into a tone of fixed frequency, amplifies it, modulates a carrier frequency and transmits it over the communications circuit. The receiver is equipped with electronic circuits which will detect that particular frequency and through interposing relays will translate the signal into the proper control function. The tones may be transmitted in on-and-off cycles, with a varying pulse count or pulse duration as in the case of electric telemetering.

Microwave transmission has application for telemetering over relatively great distances and is economically justified where private or leased wires are not practical. It involves the use of frequency modulated radio waves in definite frequency channels of 300 megacycles or higher. Of course transmitters and receivers equipped with radio circuits are required.

Combinations. As indicated, the various forms of telemetering have specific advantages, depending on the location of equipment. The distance between the transmitter and the receiver is a factor in favoring electrical transmission over pneumatic and microwave over both. There are situations where combustible gases might be present, ruling out the use of electrical equipment, in which cases pneumatic transmission is definitely advantageous. In practice, combinations are frequently employed, especially where control functions are centralized and integrated. An example is the use of electrical transmission of flow measurement to a distant control point, where the signal is converted to a pneumatic one to position a valve. Several instrument manufacturers offer equipment used in all types of transmission and can offer advice in selecting the most advantageous system.

Applications

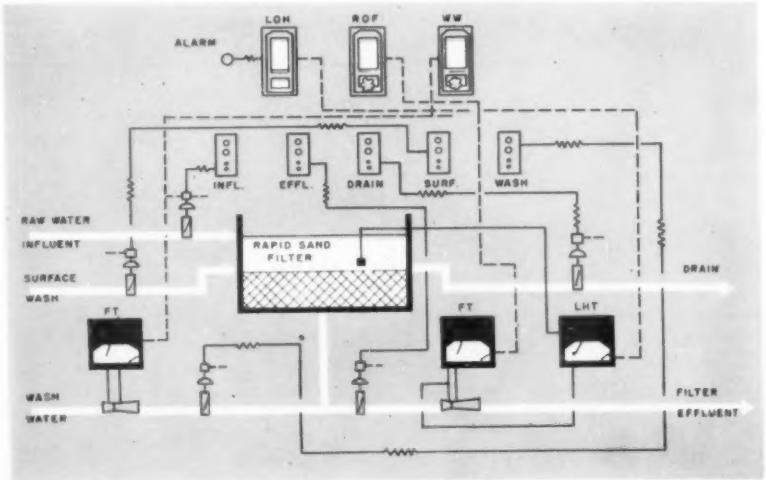
The basic application and simplest form of telemetering used in water and sewerage systems is the transmission of measurements to a conveniently located indicating and recording instrument. A centrally located instrument panel can be provided with dial indicators, chart recorders, totalizing meters, or audible and visual signal and alarm systems. These can indicate and record levels, flow rates, pressures, on-and-off operation of pumps, positions of valves, pH, chlorine residual, oxidation-reduction potential, hardness, fluorides, turbidity, dissolved oxygen and conductivity.

Fundamental Concepts. Plant and system remote control provides for the remote actuation of just a few fundamental components to achieve varying results. These components are usually valves, motors, and temperature regulating devices. By controlling the operation of a pump motor or a valve, levels, pressures, rates of flow are in turn controlled. For example, pump motors and valves control pressure. Motors also operate chemical feeders, mixing, and flocculating mechanisms. Heating and cooling devices control temperatures of laboratory equipment, digestion temperatures, and room temperatures. In many of these applications control is effected in completely automatic cycles, with a minimum of supervision. As an example, a level sensing device in a sewage wet well will start and stop pumps as raw sewage flow increases or diminishes. The equipment has been accepted by the industry so long that failing to employ it in favor of manual control would be considered almost an engineering oversight.

The source of a water supply is usually variable in its availability and in its quality characteristics. The public, in using the water supply introduces more variables by nonuniform consumption from different parts of the distribution system. When the used water is returned as sewage and industrial waste, it is again variable in rate of flow and quality characteristics. If the water supply is to be treatable and usable for modern living and the sewage treatable and disposable these varying factors must be reduced to known and predictable values.

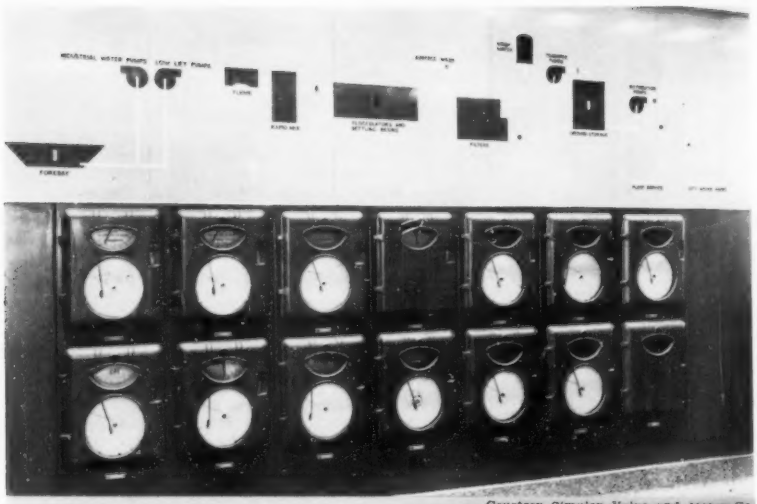
The variable factors encountered in water and sewage works practice that are subject to control are water level, pressure, rate of liquid flow, physical and chemical characteristics and temperature.

Level Control. Applications of level control include maintaining the proper hydraulic gradient throughout a water or sewage treatment plant. In a water plant the gradient is maintained by the water level in the mixing chamber. By installing a level sensing device in the mixing chamber (or flocculation basin or sedimentation basin if all three are about the same level) coupled with an appropriate transmitter and receiver, the mixing chamber level can be continuously indicated and recorded on a control panel at a convenient location within the plant. The indicator-recorder may contain a transmitter to signal a valve actuator to open or close a controlling valve, and this portion of the system becomes automated. With a pump involved, the valve can throttle the pump, or the pump can be controlled directly by off-and-on operation or through a variable speed drive. Level control to actuate a recirculation pump in a trickling filter sewage treatment plant is similar in principle.



Courtesy Fischer & Porter Co.

● **LOSS-OF-HEAD indicator alarm alerts the operator to initiate the valve operation sequence for surface wash and backwash of a water treatment rapid sand filter.**



Courtesy Simplex Valve and Meter Co.

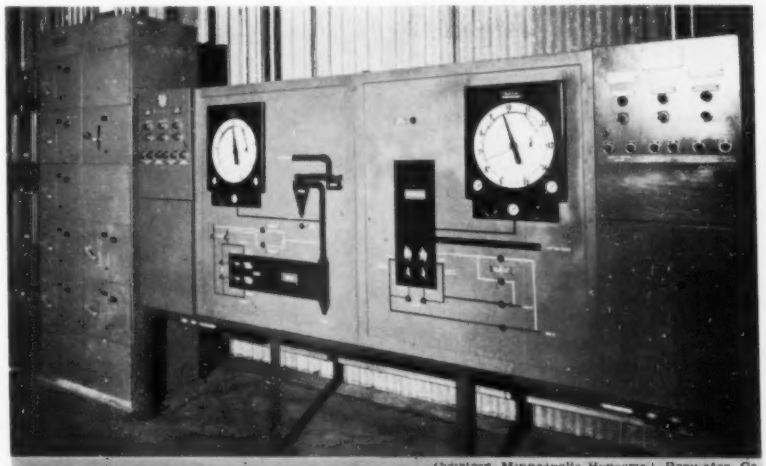
● **CONTROL center with graphic panel, San Jacinto Water Plant, Houston.**

The control of pumps in a sewage lift station is level control in reverse. It is desired to keep the sewage flowing and to avoid overflow of the wet well. With the sensing device placed in the wet well, the pumps are started and stopped in accordance with variation in level. Frequently this type of control is completely mechanical except for the switching relay, but it can involve pneumatic and electrical telemetering circuits if desired, sometimes with more precise results. Level control can be integrated with other remote control systems for batch treatment of industrial wastes for proportioning mixtures of industrial waste with sewage to avoid sewage plant upset or for maintaining pressure in a water system through elevated tank level. They can also actuate alarms if high or low water level information is important.

Pressure Control. Pressure control is applied in water distribution systems to permit maintenance of the correct fire hydrant pressure as well as sufficient pressure to avoid dangers of backsiphonage and to assure availability of water for all commercial and domestic uses. A simple example of pressure control is the automatic operation of well or high lift pumps to meet varying demands on a water system. This can be done by level control as described, or pressure sensing devices can be installed at strategic locations in the system, for example at a high point where minimum pressure would be expected. The pressure is transmitted by signal to a centrally located receiver to operate an indicator-recorder. The cycle is then completed by incorporating a transmitter in the control panel which signals a receiver and actuator at the pump station to start or stop one or more pumps as the pressure decreases or increases. To some extent the same control system can be applied to position butterfly valves in gravity flow situations or for pump throttling. Pressure sensing devices can be placed on both the suction and discharge sides of the booster pumps, with transmission to indicator-recorders at the control center, thereby providing information on available storage, line pressure and number of pumps operating. This would permit the control center dispatcher to observe the situation at the booster station at a glance and would allow him to over-ride the automatic operation if desired. Pressure control can involve telemetering a signal automatically to a starter motor for a standby diesel engine in the event of pump failure or the need of the additional pumping capacity of the diesel-driven unit. Other examples of pressure control are positioning a butterfly valve to avoid back pressures from stopping a pump and operating pilot controls on valves for pressure reduction.

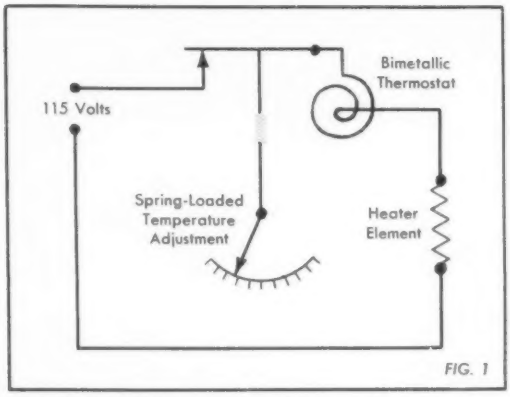
Rate-of-Flow Actuated Control. One of the earliest and best understood applications of rate-of-flow control is concerned with the operation of rapid sand filters in a water treatment plant. Whenever possible, it is desired to maintain a constant output to avoid too great a load on the filtration capacity. The filter effluent is subjected to a rate-of-flow sensing device, which opens and closes a valve through appropriate transmission and receiving mechanisms. This operation may be entirely mechanical, through the use of cables, but the modern tendency is to use pneumatic and electric transmission, especially the former. An interesting application of rate-of-flow control involves demand rates of suburban water use, when water is purchased by suburban communities from a metropolitan water system. Penalty rates are frequently imposed for high water demand during peak consumption hours. The suburban water user can avoid penalty rates by operating a flow controlling device such as a butterfly valve positioned by a transmitter preset to vary flow with the time of day.

Process Control. Treatment of water and sewage by varying chem-

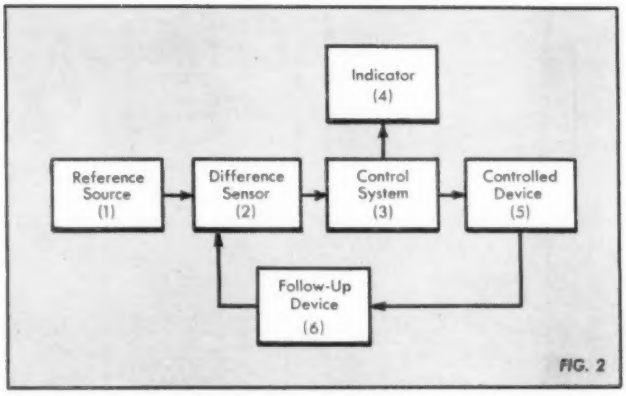


Courtesy Minneapolis-Honeywell Regulator Co.

● **OPERATING panel for sludge dryer system at Corpus Christi, Texas.**



● **TEMPERATURE control employing a closed servo loop.**



● **ELEMENTS of control system involving servomechanism theory.**

ical feed or other plant processes to meet changes in physical and chemical characteristics is a phase of remote and automatic control which is relatively new and possibly is susceptible to the most extensive modernization practices. Values of turbidity, conductivity, pH, oxidation-reduction potential (ORP), hardness, fluoride, chlorine residual, color and any constituent subject to determination by colorimetric analytical procedures may be continuously monitored by appropriate instrumentation. If these same values need adjustment and are capable of adjustment through chemical addition or through the operation of pumps, valves or motors, it follows that they are subject to remote and automatic control. With appropriate sensing devices placed in the water plant influent, the values are indicated and recorded on a control panel which also contains transmitters for signaling a variable speed motor on a chemical feeder, a valve on a gravity solution feeder, or a pump or valve for mixing two sources of water with compensating chemical characteristics. Many industrial waste treatment processes can utilize this form of control. In sewage treatment, the applications are controlling dissolved oxygen and suspended solids in the mixed liquor of activated sludge plants by actuating variable speed motors on blowers and return sludge pumps, respectively, and controlling ORP in biological coagulation, in subresidual chlorination and in recirculation of trickling filter effluent. Both pneumatic and electric transmission can be used, but some circuits, for pH and ORP monitoring, require amplifiers. Visual and audible alarms are used in chemical feed control to avoid accidental over or under dosage through breakdown of the equipment. These can also be telemetered.

Radioactivity monitoring of raw water sources, particularly, is gaining attention, and a few places have installed continuous liquid flow radiation monitors. This phase of water quality control is likely to gain importance with world development of nuclear energy; and, of course, it could become important over night. Reducing the monitoring to control functions may have to await advancement in the technology of removal of radioisotopes from water or sewage. But even with present treatment plants a degree of control is possible by diversion of radioactive water to dead storage to permit decay, or it may be done by outright rejection of a quantity of raw water and depending on existing storage if it is evident that the radioactivity of the source will diminish quickly.

Temperature regulation has some application in water and sewage works. Temperature monitoring of unattended pumping stations is important, in order to detect overheating of electric motors. The use of temperature measurement to actuate sprinkler systems in factories and warehouses to avoid fires is a well-established control device. Structures housing temperature sensitive equipment and supplies, such as chlorinator feed rooms and even rooms housing electronic equipment for control purposes, need temperature regulation. In sewage treatment, maintaining the proper temperatures in sludge digesters is an important adjunct of the digestion process. It provides assurance that the optimum conditions are available for survival and growth of the microorganisms that do the work. This, of course, is subject to regulation by controlling the heating elements used. Where sludge is incinerated, odor-free conditions depend on keeping the temperature in the combustion zone in excess of 1200°F. Temperature regulation is also involved in the heat drying of sludge.

How It Works

The definition given for telemetering includes all of the elements necessary to convey information from its source to a remote point: a sensing device which collects the information, a transmitter, and a receiver. It can be seen that this does not complete the control circuit, but it is an essential leg of the circuit, if a function is to be controlled from a remote point. In other words, the data on which control is based are translocated for the convenience of supervision. In several applications given in the foregoing section, control can be achieved without telemetering. If the function involved is an essential one such that serious problems would be created through its failure, the control should have a report back feature to the point of supervision and where applicable, manual over-riding control. The monitoring involved would make telemetering a part of the circuit. To use an analogy that is popularly understood, the driver of an automobile seldom worries about the internal lubrication of his engine, because the oil pressure is continually monitored for him by means of the gauge on the dashboard.

Servo mechanisms. The concept of sensing a change in a variable condition and using the magnitude of change to govern the position of an object, with arrangements to "feed back" the position to give the sensing device an opportunity to correct the original position of the object, is known in instrumentation language as "servomechanism" theory. The circuit involved is a "closed servo loop," and if a motor is used to do the positioning, it is called a "servo motor," although any me-

chanical device may be used. An essential part of the circuit is an outside source of energy, such as a voltage, because the signal from the sensor has negligible power and amplification is required to make it do work.

An illustration of a closed servo loop is the well-known thermostatic circuit to control temperature, shown in Fig. 1. This very elementary introduction to servomechanism theory is given because it is used very widely in designing control circuits, and the terminology is used by manufacturers in descriptions of their equipment. A generalized application of the theory is illustrated in Fig. 2. By substituting for the blocks in numerical order, a venturi tube, mercury manometer, pneumatic transmitter and receiver, a chart recorder, and a pneumatically operated valve, a servo loop is made using familiar elements. The follow-up unit is incorporated in the pneumatic receiver, the mechanism of which will be explained later. Even the situation described involving a completely automatic cycle, with telemetering used for report back and over-riding manual control, is in a sense a closed servo loop. It becomes one when the operator is considered a part of the circuit. He takes the place of the follow-up unit, correcting the control to meet whatever change in conditions may occur.

Rate-of-Flow Sensors. It is apparent from the discussions on applications that many control systems are linked to rate of flow—into a plant, for example. In such applications, the sensor for the telemeter requires a "primary device" which ordinarily measures flow rate. Most primary devices indicate rate of flow by pressure differential and are called "differential producers." This category includes venturi tubes, flow tubes, venturi nozzles, orifice plates, weirs, measuring flumes and pitot tubes. In telemetering, the sensor detects the pressure differential and relays it to the transmitter. The sensor might consist of the well of a mercury U-tube or manometer, a Bourdon tube, a float or a diaphragm, and in many forms of instrumentation it is a part of the transmitter. The manometer type sensors, the Bourdon tube and the diaphragm are used with all primary devices except the weirs and flumes. A float is generally employed as the sensing device for open channel measurement. The coordination between the primary device and the sensor can be illustrated simply with a venturi tube and mercury well arrangement. The high and low pressure lines from the upstream and throat of the venturi tube are connected to the mercury wells of a U-tube. The elevations in the wells vary according to the flow in the line. A float positioned in the high pressure well will rise and fall with change in flow. The float may be linked mechanically or electrically with the telemeter transmitter which converts the float movement into a signal.

Another type of flow measuring device employed is the propeller meter, which may be installed in a special fitting and inserted into the line to indicate flow in terms of revolutions. For telemetering, the transmitter may be geared directly to the rotating shaft of the meter, and the meter itself is the sensing device. The magnetic flow meter also has a built-in sensor. The fluid flow in a direction through and at right angles to a magnetic field induces a voltage which is directly proportional to the velocity of flow.

All of these instruments are used to measure flows in and out of water and sewage treatment plants, from one basin to another and permit remote or automatic control of any process system where there is a relation between flow rate and a variable function. There are a number of modifications of the standard venturi tube and orifice, some of them designed for a specific control function.

Pressure Sensors. Sensing elements for pressure include some of the same devices used for rate of flow but are placed directly on a line without the necessity for an intervening primary device. They are bellows, diaphragms, pistons, Bourdon tubes, pressure switches, mercury wells and others. The applications are found in measurement of line pressure, in automatic booster pump control and in pressure regulating and reducing valves. The sensing elements, transmitters and relays are often included in a single package for booster station control and for automatic valves, and the telemetering is used only for indication and recording at a control center with provision for overriding manual control.

Level Sensors. Liquid levels are sensed by floats, electrodes, or compressed air systems. In systems using compressed air sensing, air supplied by a compressor is piped to a point of submergence in the tank, reservoir or lift station wet well and is released in the form of bubbles or forms an air pocket in a pipe or bell. Back pressure in the air line caused by level increase is sensed by bellows which trigger pump switches. Because water transmits electric current, electrodes may be employed to detect levels in tanks, wells, and reservoirs. Usually two are employed for pump control, one at each level limit of the range desired. The upper will stop a pump and the lower will start it. They may be used in protective device circuits, to protect pumps from damage caused by low water levels. When electrodes are immersed in sewage, some protection against fouling is provided.

In the use of floats for tanks, reservoirs, sumps, flumes, and wet wells, the float is attached to a drum by a small cable, tape or other means and is suspended in a stilling tube or well in the liquid. The drum has a counterweight attached to keep the cable tight. The shaft of the drum is geared directly to the

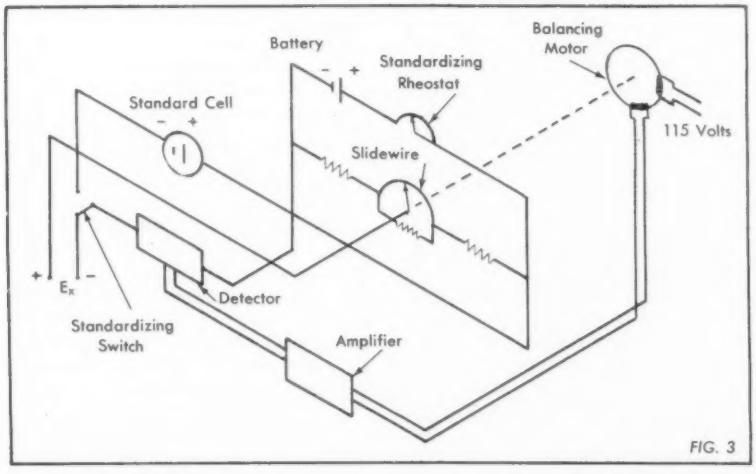
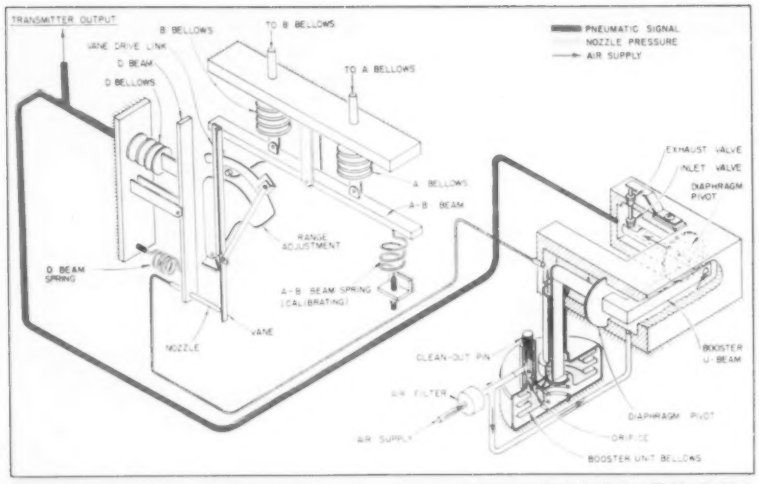


FIG. 3

● **POTENTIOMETRIC circuit for pH measurement and recording. If the measured emf and potentiometer are unbalanced, the motor is driven to reposition the slidewire.**



Courtesy Bailey Meter Company

● **PNEUMATIC signal transmitter, in which a signal is produced proportional to pressure applied at A or B bellows or to a differential pressure, A minus B.**

transmitter which will actuate mercury switches for pump operation or will operate a signal producing device for telemetering.

Quality or Process Sensors. In water and sewage plant operations controllable by pH or ORP variations, electrodes are employed as sensing elements, placed in the line, basin or reservoir. Usually a flow bypass chamber or an immersion chamber is used. A glass electrode, a reference electrode and a temperature compensator are employed for pH measurement. For ORP, a platinum electrode and reference electrode are the signal producers. The temperature compensator is used with the pH electrodes because variations in temperature affect pH-millivolt relationships. The voltage detected varies with pH of the liquid or the oxidation-reduction potential and is amplified in the indicating and recording device. Pneumatic or electric transmission can be incorporated in the meter housing for signal generation to control valves, motors or pumps or to actuate alarm systems.

Other characteristics of water or sewage for which electrode sensors are used are conductivity and chlorine residual. Conductivity of a liquid is the reciprocal of its electrical resistance and is measured in terms of mhos. As applied in control of water plant operations, two electrode cells are used, one in the raw water and the other in the treated. Conductivity difference is then measured, and control consists of adjustment of chemical feed to attain the difference representing correct treatment. Conductivity differential has been applied for control of coagulation with liquid alum, demineralization, and fluoridation. It conceivably could have other applications such as control of softening, and iron and manganese removal. Chlorine residual control involves automatic sampling and an amperometric method of analysis.

Nearly any other characteristic or chemical constituent of water which may be determined analytically by colorimetric methods is susceptible to instrumentation practice. Samples are taken periodically by an automatic analyzer; the determinations made by the use of the proper reagents; and comparison of the titrated sample with a "zero" sample accomplished by phototubes. The difference is transmitted as electric current and recorded. The sampling is accomplished by small reciprocating pumps which meter the samples with precision. This method is used industrially for silica and hardness determinations of water. Its application to other colorimetric methods and municipal water plant control is within the range of feasibility.

Turbidity or color of water or sewage may be monitored by a photoelectric colorimeter in which the liquid flows continually. The transmission of light from a standard source through a constant depth of liquid is measured by a phototube.

All of the various methods of sensing change in chemical or physical characteristics of water or sewage involve generation of a voltage or electric current, which can be amplified and measured by means of a potentiometer or Wheatstone bridge, contained in the indicating-recording unit. In circuits of this type, the input voltage or current from electrodes, a phototube or a thermocouple (used in temperature measurement) is determined by using a variable resistance to offset the resistance of the unknown (in the Wheatstone bridge) or to balance the voltage generated in the unknown against a reference voltage (in the potentiometer). In either case balance of the circuit is accomplished on a "null" basis, or at the point where no current or voltage differential can be detected. Originally balance was indicated by a galvanometer, but in modern instrumentation, the circuit is made a closed servo loop and balance is achieved by a servo motor. In this case the servo motor usually is a two phase induction motor with the input voltage applied to a field winding of the stator, 90 degrees out of phase with an a-c line voltage applied to another winding. If the circuit is out of balance, a current flows in the first field winding and a rotating flux is produced causing the rotor to move in a direction that will reduce the current flow to zero. The motor is geared to the slide wire or resistance contact shaft and also drives the indicator mechanism. This type of instrument can be equipped with an electric or pneumatic transmission mechanism to provide control.

Pneumatic Transmissions. In pneumatic control systems, the typical transmitter uses a source of clear dry air under pressure which is emitted through a nozzle. Flexible vanes are positioned over the nozzle orifice by mechanical linkage to the measuring element. Variation in the vane (or "flapper") and nozzle relationships alters the pressure in a bellows and produces a signal air pressure proportional to the measurement but usually within the standard 3 to 15 psi range. The proportional range can be adjusted for the specific control operation. The air signal is conducted through metal tubing to a selector valve which provides the automatic control selection or manual control. The signal, adjusted for the control function, is then relayed to position a butterfly valve or it can operate a pneumatically actuated rheostat for controlling the speed of a motor —on a chemical feeder, for example. Pneumatic transmitters are also used for measuring the variable quantity, differential pressure from rate-of-flow devices, line pressures or levels. A bellows or diaphragm,

in this case the sensor, adjusts the flapper nozzle. This in turn varies the pressure from the air source in a booster bellows, creating the signal. The signal is transmitted to an indicator-recorder which is equipped with a pneumatic receiver. A typical receiver uses a bellows, which, upon being actuated by the air signal, moves the indicating dial or recording pen.

Electric Transmissions. Electric transmitters have two basic functional parts, the actuating or measuring component and cam and follower linkage with a mercury switch. In a typical arrangement, a lever is actuated by the sensing device and is connected to a pointer and a trip arm and cam follower. A cam is rotated by a gear drive from the motor shaft at a constant speed, which may be one revolution in 5 to 15 seconds. As the cam rotates, the follower is under it for part of each rotation; the length of time is proportional to the measurement. The mercury switch is open when the follower is under the cam and closed when it leaves the cam. The duration of the transmitter impulse is determined by the closed period of the switch, and of course is proportional to the measurement.

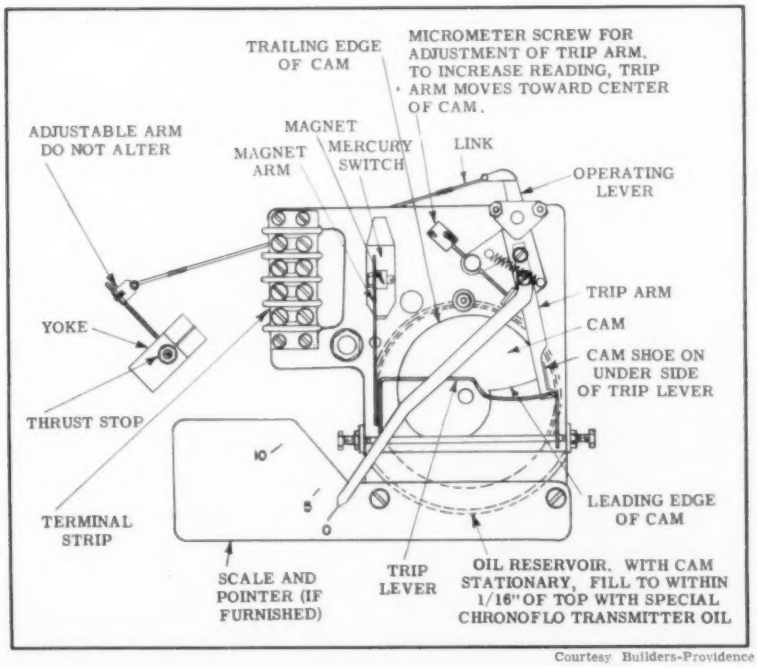
In the receiver, the signal goes to a relay coil which passes on a pulse of the same duration. The receiver also contains a cam and follower system which is synchronized with the cam system in the transmitter by means of the relay. If the pulse duration changes, the momentary difference energizes a motor or a clutch through the relays and drives a chart pen up or down to a new reading. The receiver can include an integrator for totalizing, facilities for recording up to four functions on a single chart, and facilities for retransmission of the signal or signals to a controlled device. Using the same example of the pulse duration transmission, control is effected by operation of an electric motor for the duration of the impulse of each time cycle. That type of control system would be used provided it is desired to operate the motor at a rate proportional to a flow rate or rate of change of the measured variable. The pacing of chemical feeders by rate of flow of water being treated would be an example of this kind of control system.

The timed impulse is most frequently sent by a two wire circuit either privately owned or leased from the telephone company or power utility. A power source is required to operate the equipment on both ends of the circuit. This may be a 115-volt, 60-cycle, a-c source, although sometimes direct current is required in which case a power pack is inserted in the circuit for signal purposes. Microwave transmission may be used and could be preferred, depending on the local situation.

Another form of electric transmission for control purposes involves generation of a varying voltage induced by a conductor passing through a magnetic field. The magnetic flowmeter is an example of this application. Water or sewage flowing through the meter induces a voltage by passing through a magnetic field generated by an electromagnet. The voltage induced is proportional to the fluid velocity and produces a signal transmitted to a closed servo loop. The signal is compared with a reference voltage signal which is proportional to the induced magnetic flux. Any difference indicates a change in input. The voltage differential is amplified and repositions a servo motor driving the indicator in the receiver. As with other receivers control transmissions may be added to control flow or operation of equipment. The flowmeter transmission system uses a three-wire circuit and a 115-volt a-c power source applied at the receiver.

Another example involves measuring sewage flow through a Parshall flume or open flow nozzles. A float placed on the upstream side of the throat of the flume positions a plastic covered core in an inductance coil, the position varying with rate of flow. A signal voltage is induced in a coil which is transmitted to a closed servo loop in the receiver. There the signal is compared with a reference voltage generated by a similar coil and core movement. The differential voltage is amplified and drives a servo motor at a speed proportional to the voltage magnitude. The rotation of the motor, through a cam and cam follower moves the receiver core to a position in the inductance coil to balance the circuit. The indicator-recorder mechanism is geared to the motor. This same principle is used with differential producers, with a float operating in a mercury well.

Actuation. In the method of actuation, equipment may be placed in and out of operation by a process called step control, sequence control, or step programming. It is frequently applied to pumps, with each pump being started in sequence in response to signals generated by float, flow or pressure switches. Chemical feed equipment can be made to operate automatically, increasing or decreasing its output in proportion to the flow produced by the number of pumps in operation. This is done with a relay which


TRAILING EDGE OF CAM
MICROMETER SCREW FOR ADJUSTMENT OF TRIP ARM. TO INCREASE READING, TRIP ARM MOVES TOWARD CENTER OF CAM.
ADJUSTABLE ARM DO NOT ALTER
MAGNET
MAGNET ARM
MERCURY SWITCH
LINK
OPERATING LEVER
TRIP ARM
CAM
CAM SHOE ON UNDER SIDE OF TRIP LEVER
YOKE
THRUST STOP
TERMINAL STRIP
LEADING EDGE OF CAM
SCALE AND POINTER (IF FURNISHED)
TRIP LEVER
OIL RESERVOIR. WITH CAM STATIONARY, FILL TO WITHIN 1/16" OF TOP WITH SPECIAL CHRONOFLO TRANSMITTER OIL

Courtesy Builders-Providence

● **TRANSMITTER for telemetering. This is an illustration from a manufacturer's literature and is typical of the detailed information available from such sources.**

opens and closes solenoid valves controlling the feeder output.

An additional method of actuation is called proportional pacing. Causing equipment to operate at a rate of speed proportional to the rate of flow into a plant is an application of this method. This is adaptable to the pulse duration type of electric transmission. Pneumatic instrumentation makes possible continuous proportional pacing of equipment, because the signal is continuous instead of intermittent.

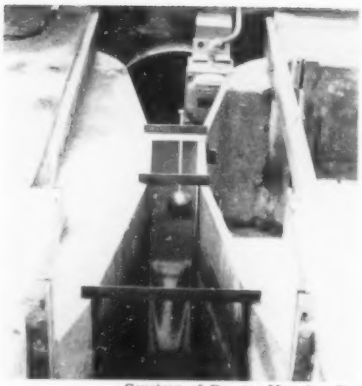
Supervisory Control

When remotely operated stations are subject to transmission of a number of control functions, those functions can be handled from a central panel on which receivers are mounted to indicate and record and retransmit signals with report-back features. This is termed supervisory control. The transmission medium becomes a problem because of the multitude of signals being employed. It is obviously not desirable to use a separate pair of wires for each signals transmission. One method of solving the problem is to reduce the signals to tones in the audio frequency range through the use of electronic tone generators and receivers. Where the tones are generated and received on a preset frequency basis, up to 25 simultaneous transmissions can be handled with a single pair of wires.

With electrical transmission of impulses, scanning switches driven by synchronous motors can be employed, one at the dispatching station and the other at the remote station. Transmitters and receivers are connected to corresponding contact points of the scanning commutators. One positions the other to carry out the command. For variable measurement the scanning mechanism at each station is stopped long enough for at least two impulse signals to be received providing assurance that the measured variable has not changed. Through other contact points controls can be operated. In addition, each control function can be checked at frequent intervals with signals to the dispatcher station. Twenty-eight control and advisory functions can be handled with a single pair of wires. Combinations of tone and electric transmissions are possible, greatly multiplying the number of points supervised and functions transmitted.

Advantages

Some of the obvious advantages of supervision by instruments are centralizing the field of operation



Courtesy of Burgess-Manning Co.

● **FLOWMETER remotely transmits a voltage variation induced by a float.**

for the convenience of the operator, reducing manpower and transportation costs, and speeding up the dispatching of commands and reporting back. A central control panel may be installed on which all operations of a plant or system are transplanted as recorded data, as controls for pumps, valves and motors, and as signals to demonstrate satisfactory or unsatisfactory operation of various units. Where plant or system units are scattered over a wide area, much time is saved over sending a man hither and yon to carry out functions or even telephoning instructions. The additional time available to the supervisor makes it possible for him to devote more effort to analyzing the different operations to determine points needing improvement. Much of the equipment in use has been applied for years in industry and has proved itself. Cost features are well known, from the standpoint of first cost, maintenance, and replacement. It must be admitted, though, that a city will usually demand more from its equipment than an industry will. In a city government, it is not always considered that there is direct relation between economy and improved process control, because the value of the improvement is sometimes intangible. For that reason equipment must be chosen with care, and ability to withstand many years of service should be taken into consideration.

Some of the less apparent advantages include the raising of the standards of the operating personnel, the early detection of deterioration of equipment through various monitoring functions, and the building block nature of much of the equipment permitting easy expansion. Personnel standards are raised in the process of dispensing with less skilled labor. Only the necessary top notch technicians are required except for routine maintenance operations. The monitoring of such conditions as packing gland leakage or excessive heating of motors is possible. This application and related ones might indicate deterioration of equipment long before casual observation would. The operation of equipment can be periodically tested to determine its condition, without the necessity of sending a man to a remote station to handle the detail. Many companies provide control equipment as components that can be plugged into the system. This facilitates not only replacement, but adding to the system as it is expanded.

Rather complete automation of segments of a system, and of entire systems when they are small, is being applied today. The degree with which the conversion to automation is taking place is gaining momentum, though automation of the larger systems may be delayed some years by the complexity of the systems and the plants. It is well, however, to consider the possibility of getting a better job done with less money. For many situations in the water and sewerage fields, it is readily apparent that this can be done.

Acknowledgement. The authors wish to thank Emory Fretz for his assistance and advice in the preparation of this article.

NEED DETAILED INFORMATION?

This article is intended as a general review of the fundamentals involved in the application of control systems to water and sewage treatment plants and related facilities. Since some of the best sources of further information are the excellent brochures and product descriptions published by manufacturers in the field, the Editors of PUBLIC WORKS will be glad to forward requests for data on specific applications to a selected list of manufacturers. To obtain such information, please state briefly your proposed application or problem and address your inquiry to: Clayton Billings, Associate Editor, PUBLIC WORKS, 200 South Broad Street, Ridgewood, New Jersey.

● LAKE AUSTIN Boulevard, three months after construction, is typical of the work done.

LOW COST STREET CONSTRUCTION *with LIME STABILIZATION*

ARNOLD R. KELLEY,

Construction Engineer,

Department of Public Works,

City of Austin, Texas

IN STRIVING for better low-cost streets and reduced maintenance costs, Austin, Texas, began using lime stabilization in reconstructing worn-out city streets. Altogether the city has 665 miles of streets of which approximately 200 miles have a base course consisting of bank-run clay-gravel having high plasticity. Most failures can be attributed to the excessive amounts of clay present in the existing base, particularly if pavement of any type has been placed.

In addition to the program of utilizing existing base materials on some of the older more poorly constructed streets, a contract was recently awarded for stabilizing with 3 percent hydrated lime, the upper 8 ins. of an existing 12-in. gravel base to be used in an overall load capacity design for the ILS Runway at the Robert Mueller Municipal Airport.

To reduce the plasticity and greatly improve the strength and stability of these in-place base materials, 3 percent hydrated lime is added to the base, followed by mixing, compacting, and asphalt resurfacing. The first job, which was undertaken last September, involved a 1700-ft. section of Lake Austin Blvd., one of the city's major arteries. This road, which is 60 feet wide, was paved with asphalt. During recent years it had been patched several times, but heavy traffic created numerous chuck holes and a general "wash board" appearance.

Before the project was started, several laboratory tests were run in order to determine how well lime reacted with this particular base material and also to determine the optimum amount of lime to use. Physical characteristics of three typical samples of the road base are shown in Table 1.

Table 1—Gravel Base Material Before Stabilization

	SAMPLES		
	#1	#2	#3
% Retained-2 in.	0	0	8.8
% Retained-¾ in.	18.4	13.7	18.7
% Retained-¼ in.	46.0	29.6	31.4
% Retained-40 mesh	72.2	62.6	62.2
% Soil Binder	27.8	37.4	37.8
Liquid Limit	35.3	37.8	31.8
Plasticity Index	19.4	21.2	20.3
Lineal Shrinkage	11.5	12.5	12.2

Representative samples were checked for each 2300 square yards of the project. Indication of benefits derived from lime stabilization are given in the following data, which gives the soil constants after 3 percent lime was thoroughly mixed with the base material on the jobs. The percent of soil binder ranged from 19.7 to 43.8; liquid limit from 24.8 to 32.1; plasticity index from 4.7 to 7.3; and the lineal shrinkage from 3.0 to 4.2.

Comparing the soils before and after adding the lime, it can be seen that the addition of 3 percent lime reduced the P.I. four-fold (from an average of 20 to 5); reduced the lineal shrinkage nearly four-fold (from 12 to 3.5); and generally reduced the soil binder content (passing 40 mesh).

This reduction in plasticity, which occurs immediately, is a result of a chemical change taking place between the lime and clay components in the soil. Lime actually flocculates or agglomerates the clay into larger particles, making the soil more friable and easier to mix and compact. A second reaction involves the cementing of the soil mixture into a stronger and more stable base material; this is believed to be a pozzolanic reaction, with the calcium from the lime combining with the silica and alumina from the clay.

Standard Construction Used

Standard stabilization construction procedure was used in the Lake Austin Blvd. project, involving scarifying, spreading lime, mixing, compacting and asphalt surfacing. An Allis-Chalmers AD 40 grader

equipped with scarifier teeth was used to scarify and loosen the asphalt surface and gravel base to a depth of 7 ins. No additional base material was needed. The roadway was then reshaped by the grader to an approximate 9-in. parabolic finish crown. The crown had been off center and non-uniform due to previous widening. A Seaman self-propelled Pulvimixer then made one pass to uniform the existing material, followed by sprinkling.

Lime was delivered in a self-unloading bulk tank body mounted on a cable dump truck. It was unloaded via two 8-in. screw conveyors into a Hercules cement spreader attached to the rear, which distributed 3 percent lime in one pass (16.2 lb. of lime per sq yd.). Considering a spreader width of 10 ft., one truck load of lime, which averaged 15 tons, covered the length of the project. Thus, six loads, or about 90 tons of lime, were required. After the lime was uniformly spread, the roadway was sprinkled to reduce dusting.

Mixing was performed with the Seaman Pulvimixer, supplemented by a disc harrow pulled by a light tractor. Water was added several times during mixing to bring the soil up to optimum moisture content of 12.3 percent before rolling. The disc harrow served to create a series of miniature trenches which permitted the water to soak in readily. Uniform mixing was accomplished in two passes of the Pulvimixer; this unit also pulverized the soil to meet the specification of 80 percent, exclusive of gravel and stone, passing a ¼-in. screen. After the optimum moisture was attained, the base was graded to true crown.

Immediately thereafter rolling operations began. Compaction to a 6-in. depth was done in one lift with a Vibroplus self-propelled 7-ton vibrating roller. With this particular soil, the best results were obtained by operating the roller at 1700 vibrations per minute and 2 mph. Only two passes were required to meet the specified Proctor density of 95 percent (the average attained was 97 percent). During rolling the base was reshaped to finished crown.

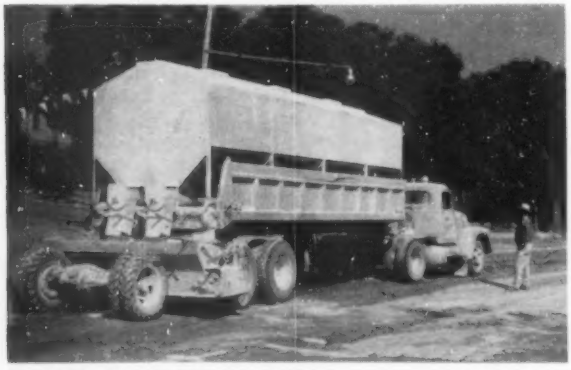
Immediately after the base was finished, it was protected from rapid drying by application of emulsified asphalt (EA-HMVS) diluted with water and spread in three applications (the total residue of emulsified asphalt was 0.1 gal. per sq. yd.). During the entire base construction, half of the boulevard was kept open to traffic. This was quite a task, since the daily traffic count was nearly 8500 vehicles.

Following a curing period of one week, the road was surfaced with a double asphaltic treatment. During the curing period normal traffic was maintained, without any detrimental effects to the base.

Low Cost Stabilization

The cost of the stabilized road was relatively low—less than $8000. The bid price was 48¢ per sq. yd. for the lime stabilization (including cost of lime and manipulation of base) and 20¢ per sq. yd. for the prime coat and double asphaltic surface treatment. The contractor was Giesen & Latson Construction Co., Austin, Texas. Hydrated lime was supplied by the Austin White Lime Co., McNeil, Texas.

Key city officials involved with the project were W. T. Williams, Jr., City Manager; S. Reuben Rountree, Jr., Director of Public Works; and Arnold R. Kelley, Construction Engineer (Public Works Dept.), who directed the project.

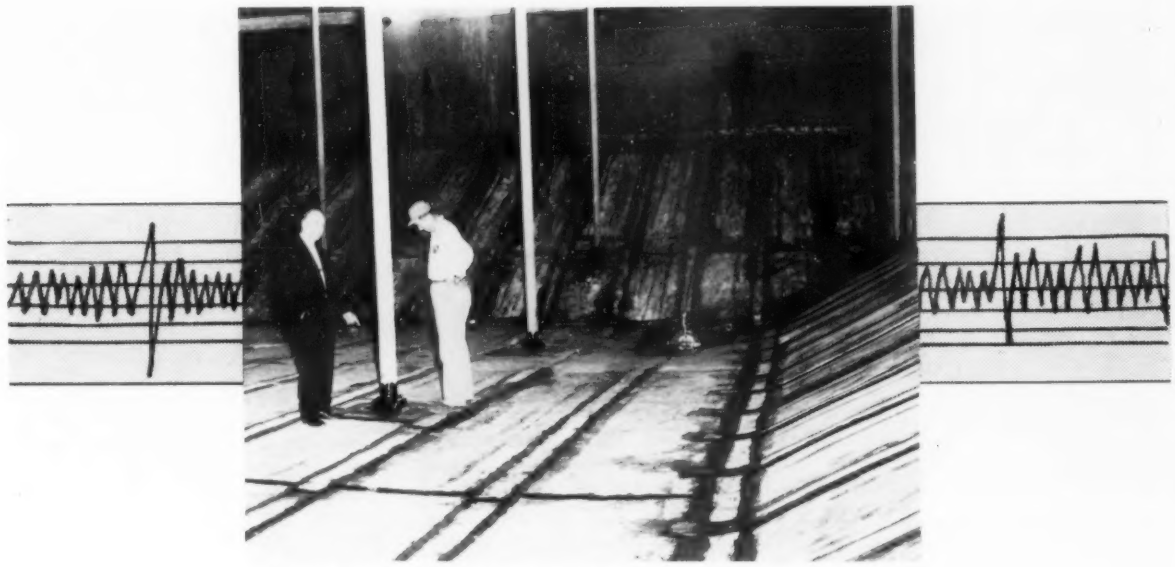


● **BULK hopper for lime. Two screw conveyors discharge to Hercules cement spreader which feeds 3% lime in a single pass.**

● **MIXING of lime with road material was performed with a Seaman Pulvimixer and disc harrow; water was added as needed.**

● **FIRST pass of Pulvimixer after the lime was added. A second pass was followed by grading to shape and then rolling.**

● **GRADER is followed closely by roller. To attain specified Proctor density (95%), only two passes were required.**



● INSIDE the reservoir, showing repairs completed. Note cracks in vertical walls which have been patched. Left is the author; at right is Carl Loescher.

Repair OF AN EARTHQUAKE DAMAGED RESERVOIR

OTIS T. CALHOUN,
Director of Public Works,
Daly City, California

MANY THINGS can happen to a new Director of Public Works, but few will shake him as much as having his largest reservoir damaged by an earthquake before his withholding statement can be prepared. I know. This happened to me in Daly City, California, on March 22, 1957, when I had been in office less than three months.

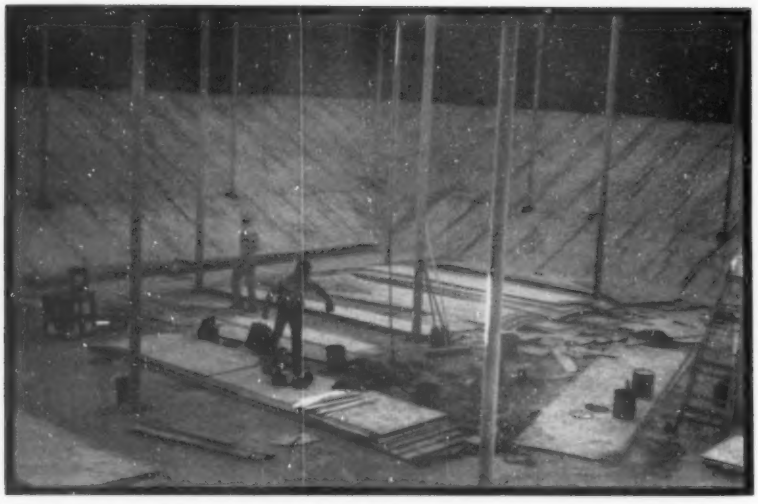
The reservoir which was damaged is located near the San Andreas earthquake fault in Daly City, California. It is 108 feet square, has a capacity of 1.6 million gallons, and is constructed of reinforced concrete with a wooden roof. The vertical walls are 11 ft. high with a nominal thickness of 10 ins. at the top and 15 ins. at the base. The bottom slab is 15 ins. thick at the base of the wall, tapers to 8 ins. thick at 10 ft. from the base and continues at a uniform thickness of 8 ins. The slab slopes downward 12 ft. in a horizontal distance of 25 ft. and continues level from that point. The roof is supported by 25 6-in. round steel columns. The four vertical walls are above grade with the ground level varying from approximately 3 ft. to 10 ft. below the top of the walls.

An inspection of the reservoir immediately following the earthquake revealed that water was running through a vertical crack which had appeared in the east wall and which extended approximately 5 ft. above the base of the wall. As it was impossible to determine immediately the extent of the damage, the water level was lowered to a point below the crack to lessen the possibility of further damage in the event other shocks followed.

Since this reservoir was the only source of supply for the area, it was necessary to keep it in service at approximately one-third capacity until a temporary tank was installed. A 50,000-gallon redwood tank was erected near the site of the damaged reservoir and connected to a 12-in. transmission main which was supplied from a lower reservoir by booster pumps controlled by float switches in the tank. This arrangement supplied the area with sufficient water under satisfactory pressure during the time the reservoir was out of service.

After the temporary system was installed and tested, the reservoir was drained and inspected. It was found that the crack in the vertical wall extended into the floor slab for a distance of approximately 10 ft. and that other vertical cracks had developed at the inside corners of the walls but had not extended to the outside. A series of horizontal cracks in the sloping slab and at the juncture of the horizontal and the sloping floor slabs were discovered. It could not be determined whether all the cracks were caused by the earthquake, but it is my opinion that some of them had existed previously, though undetected.

Excavations were made around the exterior walls and under the base in an effort to discover any



● **AFTER grouting and crack sealing, the entire floor slab, including sloping sections, was covered with asphalt lining. The panels are shown piled on the floor.**

voids which might have been created by the leakage, and those that were found were filled by tamping select material therein.

After the extent of damage had been ascertained, several engineers, including the designer of the reservoir, were consulted; and various possibilities were explored before a method of repair was decided upon. Consideration was given to guniting the entire interior surface; but this method was ruled out, as it was feared that any subsequent settlement or movement of the reservoir might cause new cracks to develop in the gunite at the same location as the cracks in the existing structure. Sealing the cracks with mastic and fabric was also considered; but since the cracks were so numerous and the probability of missing some of them so great, this method was likewise discarded.

The method finally decided upon is as follows:

A total of 85 2-in. diameter inspection holes were drilled through the slab in checkerboard fashion on approximately 15-ft. centers for the purpose of locating any voids underneath. Where voids were discovered, grout composed of cement, sandy loam, and sand was pumped in the hole at low pressure. After experimenting with several mixtures, it was found that one composed of 6 sacks of cement, ½-cu. yd. of loam, and ½-cu. yd. of sand provided the best results. The material was mixed in a power mixer similar to a plaster mixer and pumped into the holes through a 2½-in. rubber hose and nozzle.

All cracks in the walls and all large cracks in the floor slab were chiseled out in a "V" shape, 2½ inches wide at the surface and a minimum of 2 ins. deep. The cracks were then filled to within ½-in. of the surface with "Quick Set", a fast setting hydraulic cement with expansive properties made by the Dry Mix Materials Co., Roseville, Calif. The balance of the crack was then filled with Indaco Mastic made by Indaco, Inc., Culver City, Calif. Indaco Mastic is made up from two bituminous components, one dry, the other liquid, which when mixed together form a soft adhesive mastic.

After the grouting and crack sealing were completed, the entire floor slab, including the sloping sections, was covered with ½-in. thick "Panelcraft" reinforced molded asphalt lining made by the Envoy Petroleum Co., Long Beach, Calif. This lining was furnished in panels 4 ft. wide and 20 ft. long. The ends of the panels were joined with lap joints which were formed by lapping the panels 8 ins. and bonding them together with hot applied asphalt adhesive. The sides of the panels were joined with butt joints which were formed by fitting the panels closely together and covering the joint with a cover strip 8 ins. wide. This cover strip was likewise bonded to the panels with hot applied asphalt adhesive.

The panels were installed on horizontal and sloping floor slabs and extended to the vertical wall where they were bonded to the surface with hot asphalt adhesive. The ends were then secured by the use of a 2-in. by 3/16-in. thick galvanized metal strip which was coated with asphalt and fastened to the slab by Ramset fasteners at approximately 12 ins. center to center. A panel 8 ins. wide was then butted against the floor panel and fastened to the vertical wall in a like manner.

Cold Asphalt Mastic

After the panels were installed, all joints were coated with cold asphalt mastic. The area around the columns was sealed in a manner similar to the juncture of the vertical wall and the floor slab and then mopped with hot tar. This type of lining provides a floating liner which conforms to the contour of the structure.

When the lining was completed, it was allowed to stand for 7 days to allow the mastic to set. The reservoir was then filled with water to a depth of 1 ft. and sufficient HTH powder added to provide 50 ppm residual chlorine. The entire surface was scrubbed with this solution and allowed to stand 24 hours. At the end of this period, the solution was drained out and the reservoir rinsed with clear water and filled ready for service.

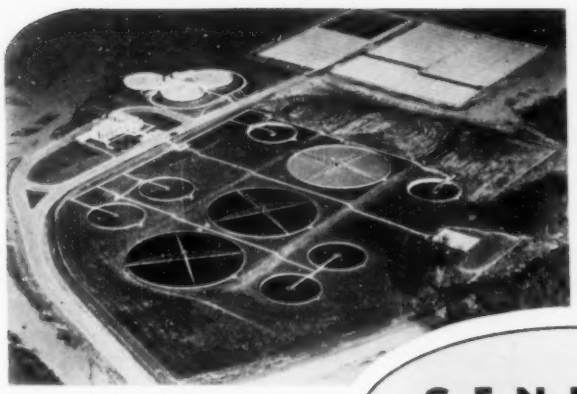
While it is a little early fully to evaluate the effectiveness of the repairs, it appears at this time that they were successful, as no leaks have been discovered.

It is proposed that the reservoir will be drained and inspected after it is in service for 6 months and thereafter, every year. When it is drained and inspected, any places which are doubtful as to watertightness can easily be repaired by cementing patches of Panelcraft over the area or by the use of asphalt mastic.

Waste Treatment for a Grape Juice Plant

Based upon operation of a pilot plant, additional treatment facilities have been provided for the wastes from the Welch Grape Juice Co. plant near North East, Pa. During processing season, pretreatment is provided by a primary settling tank and a 30-ft. diameter high rate filter, utilizing recirculation and with secondary clarification. This plant provides complete treatment during the off season.

Additional treatment is furnished during the processing season. From the pretreatment plant, the waste passes to a lagoon and is then pumped to a 100-ft. diameter high rate trickling filter. The effluent from the filter is discharged to a second lagoon for further clarification before discharge into a stream.



Courtesy Dorr-Oliver

● 12 MGD biofiltration plant serves Raleigh, North Carolina. The three filters are each 190 ft. in diameter.

Courtesy Yeomans Bros. Co.

● FOUR Aerofilters, 80 ft. diameter by 6 ft. deep treat screened sewage at the Rochester, Minnesota, plant.

GENERAL DESIGN

FOR HIGH RATE FILTERS

THE MUCH heavier organic loadings used with high rate filters have resulted in the use of a variety of terms to designate such loading. The rather commonly used basis, with low rate filters, of pounds per acre-foot, was applied to high rate filters, and loadings of 2540 to more than 3000 pounds per acre-foot were common. Some engineers reduced this loading to a cubic yard basis, dividing the acre-foot loadings by 1613. Recently, there has been some use of 1,000 cubic feet as a loading basis, and it has been recommended by a committee of the Federation of Sewage and Industrial Wastes Associations that such usage be standardized in sewage treatment practice. Since 1,000 cubic feet equals 37 cu. yds., the cubic yard loading is multiplied by 37 to obtain the 1,000 cu. ft. loading. Thus, 3,000 lbs. per acre-foot is the same as 1.86 pounds per cubic yard or 68.8 pounds per 1,000 cubic feet. There may be a slight saving in time in making design computations by either the cu. yd. or the 1,000 cu. ft. basis, but most formulas now in general use, for determining filter efficiency are based on the acre-foot.

High rate filters are of three principal types, each of which can be adapted to local conditions by simple modifications in rate of feeding, recirculation or loading. These three filter types are:

The *Biofilter*, which is shallow, usually 4 to 5 ft. deep, utilizes recirculation of a portion of the filter effluent back to the primary settling tank for a second passage through the filter. If additional treatment is necessary, a second-stage filter may be provided, and the final effluent is subject to modification by changing the loading rate and recirculation ratio. Organic loadings are of the order of 2500 to 3000 pounds of BOD per acre-foot or 1.5 to 1.9 pounds per cubic yard based on the strength of the primary tank effluent. The volume loadings range from 10 mgad to 30 mgad.

The *Accelo-Filter*, which is relatively deep, has direct recirculation of unsettled filter effluent back to the inlet of the distributor. This principle may be used on either low rate or high rate filters. With the latter, recommended applied organic loadings range from 2,540 pounds of BOD in northern areas to 3,000 pounds in southern areas per acre-foot. This is equivalent to 1.5 to 1.9 pounds of BOD per cubic yard, based on the organic content of the primary tank effluent.

The *Aero-filter* utilizes a low momentary rate of sewage application to the filter. This is accomplished by means of special distributing apparatus designed for "raindrop" application over a maximum area of the filter at one time. Recommended organic loading ranges from 3000 to 3200 pounds of BOD per acre-foot, or 1.9 to 2.0 pounds per cubic yard, based on the applied sewage. Recirculation is used only during periods of low sewage flow, and then only in amounts necessary to maintain the flow requirements of the distributor for proper functioning. If additional treatment is required, a second-stage filter may be used.

A new development is the *Superate* filter, designed by Harry Jenks, California consulting engineer. This filter, which is very shallow, is dosed at rates as high as 400 mgad.

Because of the heavier organic load that is applied to a high rate filter per unit of filter volume, the effluent from a single-stage high rate filter will be higher in BOD than that from a lightly loaded filter. To overcome this factor, the effluent from the filter may be mixed with the incoming raw sewage and passed again through the filter; or two filters, in series, may be used. These procedures may result in treatment comparable to that from a filter that is loaded less heavily, while the smaller units required in the high rate process may reduce construction costs materially.

Stages, Recirculation and Loading

In high rate filters, a single-stage plant is differentiated from a two-

Courtesy Dorr-Oliver Inc.

● **HIGH RATE filter serves Hollywood, Fla. The plant, planned by Smith & Gillespie, is designed for a population of 30,000. There are two 85-ft. distributors.**

stage plant by the fact that in the latter the sewage is passed successively through a primary filter and through a secondary filter. Recirculation may be applied to both filters.

Thus, a single-stage filter is one in which the filters, if there are more than one, are operated in parallel. Sewage may be, and usually is, recirculated through single-stage filters, the effluent from each filter being passed to a secondary settling tank after or before withdrawing the portion that is to be recirculated.

In a two-stage filter, the effluent from the primary filter or filters, after withdrawing the portion that is to be recirculated and returning it to and through the primary filter, passes to a second filter; and the effluent from the second filter, less recirculation, is discharged to the final settling tank.

Recirculation Arrangements

There are many variations in the arrangements for recirculation. In a single-stage filter, the most common arrangement is to return a portion of the filter effluent to the inlet of the primary settling tank in the case of the Biofilter; and to the distributor in the case of the Accelo-filter. In the two-stage plants, the most used plan is to return a portion of the primary filter effluent for another passage through the primary filter; and a portion of the secondary filter effluent for another passage through the secondary filter.

However, excessive recirculation is not necessary. Very good effluents can be obtained with recirculation ratios of 0.5 to 1.

Loadings on high rate filters must be considered from two bases: The organic loading in pounds of BOD per acre-foot, cubic yard, 1000 cubic feet, or square foot of surface area; and the rate at which sewage is applied to the surface, usually in millions of gallons per acre per day.

The organic loading is based on the strength of the sewage applied to the filter. In design, it is common practice to allow 30 percent to 35 percent removal of BOD in the primary settling tank and to assume that 65 percent to 70 percent of the raw sewage BOD will be applied to the filter. In this text, a removal of 30 percent in the primary settling tank has been assumed.

Much heavier loadings than those stated above are applied to the primary filters of two-stage plants. In a two-stage plant, the same volume of filter media is used as for a single-stage plant, but the media is divided, usually equally, between two filters. The entire organic load, after primary settling, is applied to the primary filter. This may result in loadings of 3 to 4 pounds per cu. yd. or 4800 to 6400 pounds per acre-foot. In effect, the primary filter becomes what has been called in the past a roughing filter, with the principal function of removing BOD and preparing the sewage for the final passage through the second filter.

Volume loadings range from 10 mgad to upward of 30 mgad, based on the surface application rate. Assume a sewage flow of 1 mgd, a recirculation ratio of 0.5 to 1, and a two-stage filter. If the BOD of the raw sewage is 240 mg/L and the removal in the primary is 30 percent, the organic load on the filter will be $8.33 \times 240 \times 0.70 = 1400$ pounds. If the unit organic loading in the filter is 1.75 pounds per cubic yard, 800 cu. yds. of media will be required, divided into two filters, each containing 400 cu. yds. If the filters are 5 ft. deep, the surface area of each will be 2160 sq. ft. or about 0.05 acre. Since the daily flow of sewage plus recirculated effluent will amount to 1.5 mgd, the surface loading on the filter will be about 30 mgad.

If a single-stage filter were used, all of the 800 cu. yds. of filter media would be in a single filter, and the volume loading rate would be half as great, or 15 mgad.

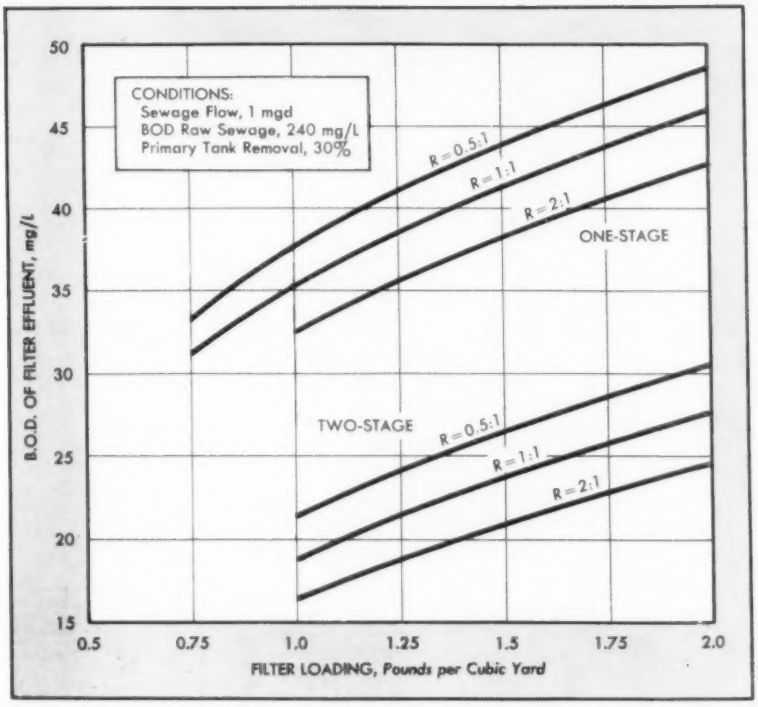
Few plants are designed for rates much above 30 mgad and 50 mgad is about the maximum that has been used except for the Jenks Superate filter which may reach a volumetric loading as high as 400 mgad.

Formulas for Design

From studies of military sewage treatment plants during World War II, a subcommittee of the National Research Council developed formulas which permit the computation of probable results from trickling filters and thus afford a basis for design. In these formulas, weight is given to the organic loading placed on the filter, and also to the ratio of recirculation, since it was found that these factors affect the quality of the effluent. The volume of filter media is stated in acre-feet. The organic loading is a function of the BOD loading, the acre-foot volume of the filter, and the recirculation factor.

Since, in recirculation, part of the organic material is removed in each passage through the filter, a recirculation factor F is derived from the recirculation ratio by means of the following formula, where R is the recirculation ratio:

$$F = \frac{1 + R}{(1 + 0.1R)^2} \quad \ldots\ldots (1)$$



● **EFFECT of recirculation ratio on effluent BOD according to the NRC formula.**

For a 1 to 1 recirculation ratio, F is 1.65 and for a ratio of 0.5 to 1, F is 1.36.

The percent efficiency of removal of BOD in a trickling filter and its following clarifier is expressed by formula 3 below, where E is the efficiency in percent of removal of organic matter and L is the organic loading. L is derived by formula 2 below and, for filters with recirculation, is based on pounds of BOD applied, filter volume and recirculation. With V representing filter volume in acre-feet, F the recirculation factor and W the pounds of applied BOD,

$$L = \frac{W}{V \times F} \quad \ldots\ldots\ldots\ldots (2)$$

Thus, if applied BOD is 1400 pounds, V is 0.5 and F is 1.65, L = 1700.

The filter efficiency formula is

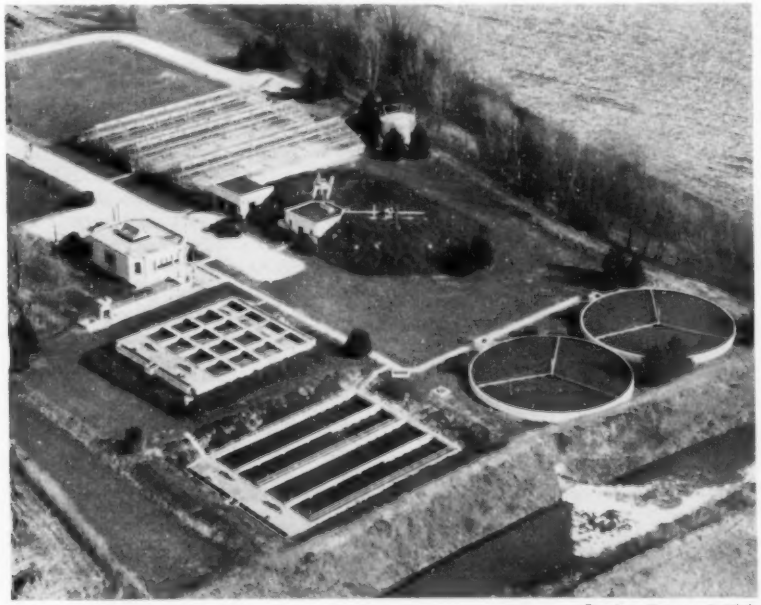
$$E = \frac{100}{1 + 0.0085 \sqrt{L}} \quad \ldots\ldots\ldots\ldots (3)$$

and where L = 1700, the efficiency of the filter and accompanying clarifier will be 73.7; that is 73.7 percent of the applied BOD will be removed in the filter and clarifier (not considering the removal in the primary clarifier).

Thus, for the example cited, removal in the filter and following clarifier will be 1400 × .737 or 1032 pounds. BOD remaining in the effluent will be 1400 — 1032 = 368 pounds. Overall removal in the plant, including that in the primary clarifier will be 81.6 percent.

The above formula applies to any single stage high rate filter no matter what the rate of loading. It also applies to the primary filter of a two-stage plant; but it does not apply to the second stage filter of such an installation.

Another reliable formula is the one based on studies of the Upper Mississippi Basin Sanitary Engineers, also called the "Ten States Standards." These studies indicated that when the rate of BOD application to the filter surface was in the order of 0.45 pound per sq. ft. per day, a removal of about 63 percent of the applied BOD was obtained. This figure fixes the area of the filter and also the strength of the sewage applied to the filter in relation to the effluent.



Courtesy Burgess & Niple

● **FILTERS at Lancaster, O., treatment plant are designed for a loading of 1.8 pounds of BOD per cu. yd., with application rate of 20 mgad. Population is 28,000.**

Treatment Results

Single-stage high rate filters will normally produce effluents of the order of 40 to 45 mg/L BOD when loaded in the range of 2400 to 2800 pounds of BOD per acre-foot. Two-stage filters, with the same loading will normally produce effluents in the range of 24 to 28 mg/L BOD. The Liberty, N. Y., treatment plant, which was designed for a loading of 3.1 lbs. per cubic yard, with two-stage filters, has shown consistent reduction in the overall BOD of more than 92 percent, though it is now loaded considerably above design during the summer months. The filter volume is 0.23 acre-foot; the BOD loading applied is 3920 lbs. per

acre-foot of which 3579 pounds are removed. This plant is quite typical, in its operating results, of a number of plants of this type constructed in the Catskill summer resort area.

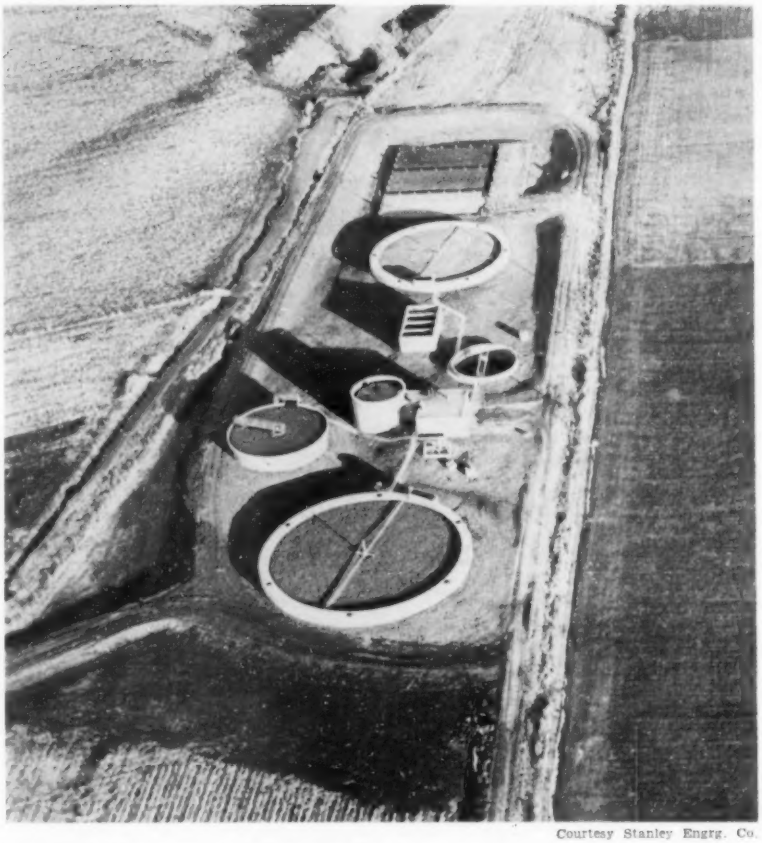
Olney Borden, Consulting Engineer, Liberty, N. Y., has furnished winter and summer operating results for three two stage plants operating in that area. The Liberty plant in Jan., 1958, with temperatures ranging from 10 to 35°F, produced an effluent having a BOD of 30 mg/L with raw sewage flow 0.6 mgd and raw BOD 310 mg/L. In February, 1958, using secondary recirculation only, the effluent was 60 mg/L, the temperature ranging from 14° to 23°. In Aug., 1956, with a flow of 1.0 mgd and raw sewage BOD at 340 mg/L, the effluent carried 30 mg/L BOD.

At Monticello, February results for 1954, 1955 and 1958, under temperature ranges of 14° to 23°, showed effluents averaging 12 mg/L, for flows of 0.53 mgd and raw sewage BOD of 170 mg/L. July and August results show raw sewage BOD averaging 450 mg/L, a flow of 1.15 mgd, and effluents at 25 mg/L BOD. At Monticello, full recirculation is maintained in the winter months.

The small Kiamesha Lake plant in Jan. and Feb., 1958, with an average raw sewage flow at 0.2 mgd and BOD at 85 mg/L had an effluent averaging 16 mg/L. An average of August results in 1954, 1955 and 1956, showed a raw sewage BOD ranging from 260 to 460 mg/L, flows of 0.4 to 0.45 mgd, and effluents from 39 to 50 mg/L. Full recirculation is maintained, winter and summer. Additional digester capacity is needed at this plant.

Design Details

Of the many methods that can be employed for arranging recirculation, perhaps the simplest are those that provide for the continuous operation of the recirculation pump at a fixed rate. This method results in returning a specific volume of recirculation and not a proportional part of the sewage flow. It has the advantage of avoiding the necessity for frequent starting and stopping of the recirculation pumps and permits the use of a small pump sump. In the single-stage filter, the pump sump is placed between the filter and the secondary clarifier, on the discharge line from the filter to the clarifier, and floating on the latter. A pump in the sump can then draw on the secondary clarifier during the period of starting recirculation, and the pump needs no other control than a safety cutoff to operate when the sump and secondary clarifier level falls some fixed amount—usually 2 to 3 ft.—or rises unduly.



Courtesy Stanley Engrg. Co.

● **SEWAGE treatment plant at Clarinda, Iowa, employing filtration, was built by cooperative arrangement between city and state to serve city and state institution.**

The same general arrangement can be used with two-stage filters. In this case, there will be two sumps, normally with an open connection between them. The primary sump receives the flow from the primary filter. That part of the flow not returned to the primary clarifier by the primary recirculation pump overflows to the secondary sump, which should float on the line from the primary sump to the secondary clarifier. The secondary recirculation pump can deliver either directly to the secondary distributor or to a dosing tank. Discharge from the secondary filter is direct to the final clarifier.

Where head is lacking for gravity operations of one or both filters, pumping of the settled sewage is possible. The Suffern, N. Y., plant, designed in 1957, in order to avoid possible flood damage, located both primary and secondary filters above the levels of the settling tanks. The pumps, drawing from sumps at the tanks outlets, pump about 16.75 ft. to the distributors. This is an economical procedure and permits use of the plant even during high water.

In an installation using this method, it will be necessary to have the surface level of the secondary clarifier a few inches below that of the primary tank. Otherwise the primary tank outlet weir will flood. Various arrangements of the sumps are possible, but in all cases a connection between the primary and secondary recirculation sumps is necessary; and there should be provision for drawing from the secondary settling tank to the secondary recirculation sump to insure flow during start-up periods.

Distributors for high rate filters differ from those for low rate filters in the volume of flow they can handle. Usually a 4-arm or 3-arm distributor is used. Basic data on size of filter, rates of flow, conditions of operation and head available are required by distributor manufacturers for designing their equipment. The maximum and minimum rates of sewage flow are especially important.

HIGHWAY EQUIPMENT COST ACCOUNTING
Can be Easy

CLAYTON HENDERSON
Highway Superintendent,
Obion County, Tennessee

MANY county highway departments apparently feel that cost accounting on their equipment is an expensive luxury. It isn't. Obion County has kept records for many years, and we have benefited in many ways—better care by operators, identification of costs of each machine, status of machines and parts, assistance in budgeting for our road program and an easy way to show the public how the money has been spent.

Before we get too deep, let me say that our budget is not large—for 1958 it is $330,000. We must live within this budget, maintaining 1000 miles of roads, many through rough terrain and river bottom lands, and pave some as we can. Every penny must go as far as possible. So we have developed a system that tells us exactly what it costs to operate every piece of equipment we own, a system that requires each operator to make only a few notations and one secretary to correlate and post the data.

Like every other county in the country, we have a large equipment fleet. We have 11 motor graders, 16 gravel trucks, 7 pick-up trucks, 1 car, 3 crawler tractors, a ¾ yard shovel, a ⅝ yard dragline, 1 low boy, 10 trucks for the bridge gang and a concrete tile machine. We have 60 employees in the highway department.

Complete records are kept on each machine, originating with the daily report cards, work orders and purchase orders. Each operator maintains a daily report card for his machine, listing all consumable items such as fuel, oil, and grader blades. Members of the gravel and bridge gangs turn their cards in to their foremen; grader and tractor operators turn their cards in weekly to our secretary.

All service and repairs, including parts and labor, are reported on work orders, prepared by our secretary. Parts used are noted as they are drawn from supply, and labor is reported on the mechanic's time card. Costs for parts and supplies are available from purchase orders.

These costs are recorded in a permanent ledger, with a page for each machine. Costs are posted twice a month, totalled once a month. From these figures it is easy to find out which machines are producing at the least cost—a guide to better buying—and which machines have rising costs—a guide to timely replacement. For example, during fiscal 1956, it cost us 71 cents per yard to haul gravel in our 1956 model trucks and 89 cents per yard in our 1954 models. During the same period our graders each cost an average of $3073.80 for all owning and operating expenses.

This is how we keep our cost records, and what they show. Now, how do we use them? One useful purpose is to stimulate competition among our operators. Each man wants to show that he can operate his grader at a lower cost than can the others. They ask us for a copy of the cost accounting on their equipment. They study it and look for ways to help cut operational costs. I might add this keeps morale high and results in more efficient operation of the department.

Our cost accounting also shows when it no longer pays to maintain a truck or motor grader. Because we can watch costs daily we know when maintenance becomes so expensive it is cheaper to buy new equipment. At the same time these cost records show which make of truck or grader provides the greatest operating efficiency.

These records provide us with a constant inventory. We know what equipment we have and what it is doing. And we know when it is time to order another dozen blades for our graders.

Probably one of the most important benefits is the assistance these records provide in budgeting our funds for the road program. We can look at our records and see how much it will cost us to haul gravel or to grade a road. We know how much equipment we will need to get our work done. Without this accounting, we would have to budget on a hit-or-miss basis.

Finally, our records allow us at any time to show the public exactly how we are spending the money. We can show how much a certain job costs. Above all, they lead the way to more efficient operation.

Courtesy Caterpillar Tractor Company

● **DITCHING TEAM. No. 12 motor grader pulls a No. 212 to make fast, deep cut.**

Underground
SEWAGE PUMPING STATION SOLVES DIFFICULT SITE PROBLEM

C. RICHARD WALTER,
Hazen and Sawyer, Engineers,
New York, New York

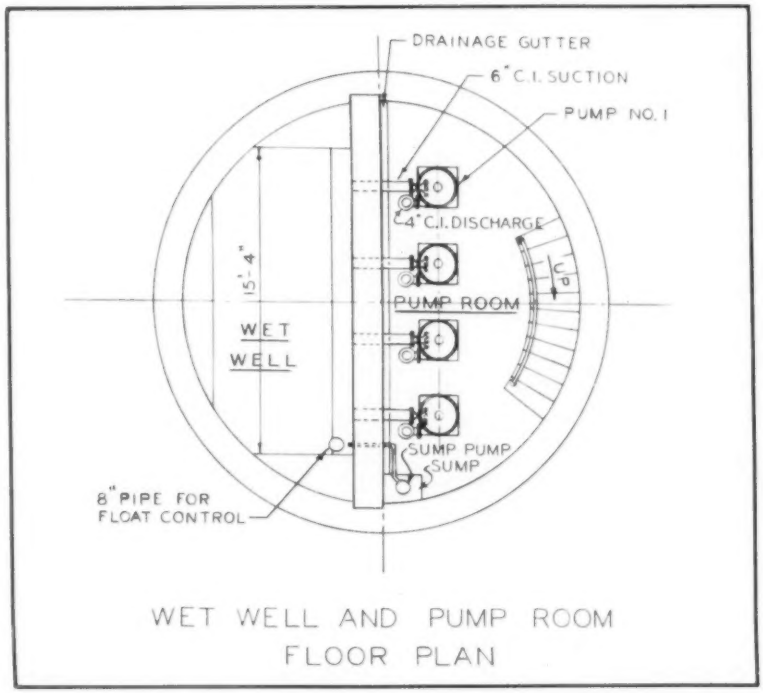
AN UNDERGROUND sewage pumping station at the Garden State Plaza shopping center in Paramus, N. J., effectively solved the twin problems of a conspicuous site and poor foundation conditions. The station pumps all the sanitary sewage from the center to a package-type sewage treatment plant on the site for complete treatment. Because it was necessary to locate the pumping station near one of the main entrances to the center, it was desirable to have the station be as inconspicuous as possible. The 14-foot depth of the sewer at the outfall end of the Plaza collection system dictated a deep wet well in any event, so the pumping station was designed as a completely underground structure. Set in the middle of a small grassy plot and surrounded by low shrubs, the station is scarcely noticeable to the thousands passing by daily.

One of the first problems encountered in the design was a lack of available information on sewage flows to be expected from a shopping development the size of the Plaza. Most other large shopping centers discharge sewage to existing systems, and sewage flow measurements were not available. Water consumption records were obtained from numerous centers, however, and a study was made of these data to determine probable sewage flows. In this study the make-up water used in the air conditioning system of various developments* was deducted from the total water usage since this water is lost in evaporation and does not reach the sewers. The results of this study are summarized in Table 1.

It seemed reasonable that almost all the flow would occur during a twelve hour period so that the average daytime rate was assumed to be twice the mean rates. In the same fashion the peak rates were assumed to be twice the average daytime rates (4 x mean).

The Garden State Plaza was planned to include 950,000 square feet of gross floor area in the first stage of development, with eventual expansion through a series of five stages to a total eventual gross area of 1,900,000 sq. ft. The flows to be expected at the sewage pumping station in both the initial and ultimate developments are covered in Table 2.

In order to pump sewage to the treatment plant with a minimum of surges, it was decided to install several pumps having different capacities. Due to the long force main required, friction losses became an appreciable portion of the total dy-

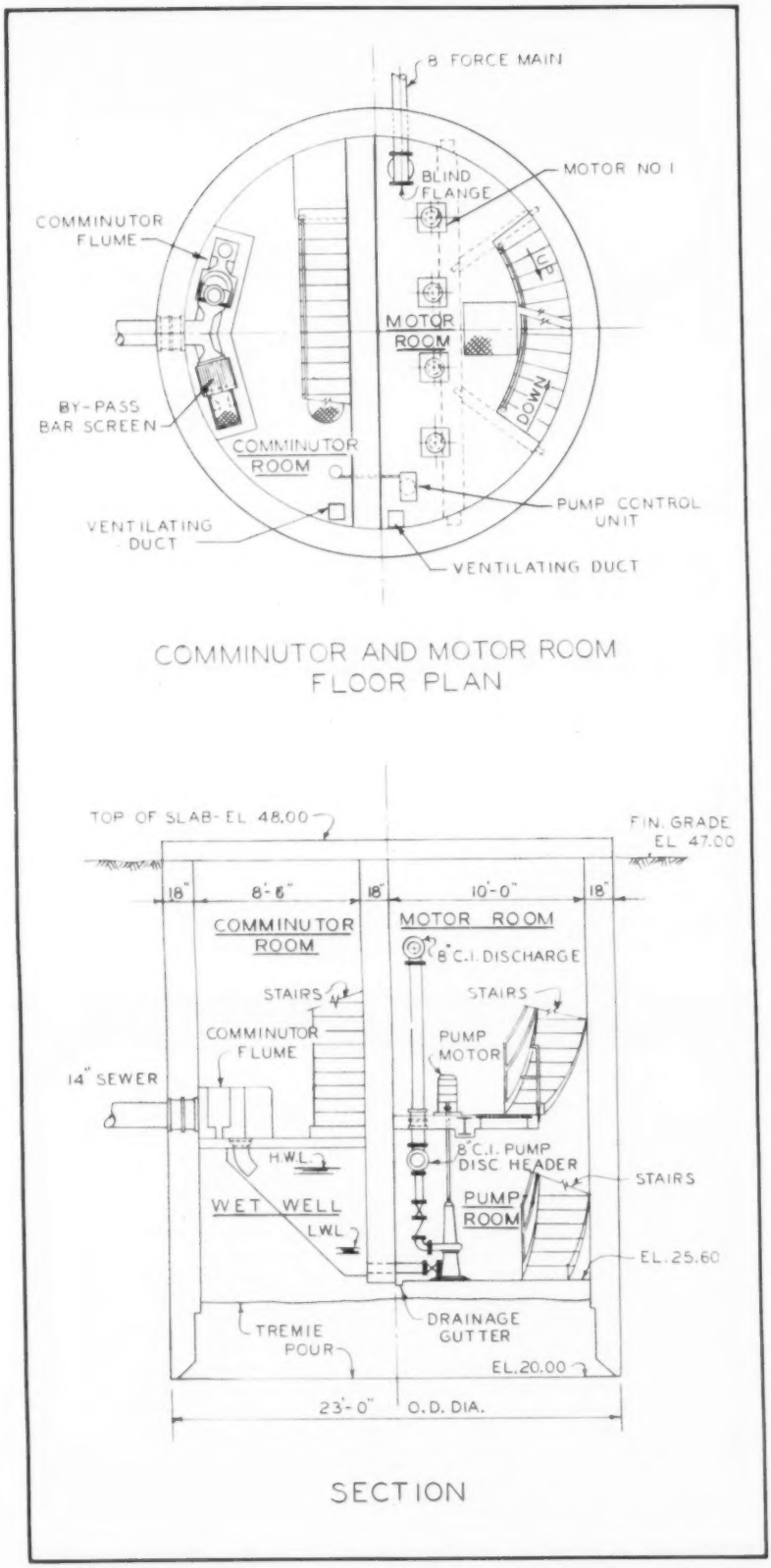


● **UNDERGROUND sewage pumping station for a shopping center showing the wet well and pump room floor plan, with four pumps of 80 to 375 g/p/m capacity.**

Table 1—Shopping Center Sewage Flows
Gals./day/sq. ft. of gross floor area

	Mean Annual	*Maximum Month*
Water Consumption (Not incl. air cond. make-up)	0.085	0.110
Not Reaching Sewer (Lawn sprinkling, street washing)	0.008	0.015
Net Sewage Flow	0.077	0.095
Adjust for 6-day Week (x 7/6)	0.090	0.111

* Air conditioning make-up water in the summer months varied from 0.02 to 0.10 gpd/ft.^{2}.



● **COMMINUTOR and motor room floor plan above; section through pumping station below, showing arrangement of units, piping, and high and low levels in wet well.**

Table 2—Pumping Station Design Flows

	Initial	*Ultimate*
Mean Annual Flow	50 gpm	100 gpm
Avg. Daytime Rate	100	200
Peak Rate	240	480

namic head at higher pumpages. Pumps of the type and size chosen for the station have relatively flat discharge curves, and it was not feasible to run two smaller pumps together to meet the higher discharge requirements. The largest pump was designed to handle flows considerably in excess of those initially expected. Final pump selection consisted of 4 pumps having capacities of 80, 175, 265, and 375 gallons per minute. It was anticipated that ultimately the smallest pump would be replaced by a larger unit.

Experience since June, 1957, when the station was placed in operation has shown that the actual mean flow (40 gpm) and average daytime rate (80 gpm) are fairly close to the design rates. However, the peak rate experienced so far (130 gpm) is much less than the anticipated peak. From the flows experienced to date, it appears that the present pumps will be ample to serve the ultimate development of the center.

Site Difficult to Dewater

Borings at the site and experience with other excavations near-by indicated that the site would be extremely difficult to dewater and excavate in the dry. The pumping station was to be constructed in fine sand and silt about 40 feet away from Sprout Brook whose bed elevation was 8 feet above the desired bottom of the wet well.

It was decided to design the station in the form of a circular caisson. The caisson was lowered into proper position by excavating the material out of the center with a clamshell bucket, allowing the caisson to sink under its own weight. When the cutting edge of the caisson reached the desired elevation, the interior bottom was leveled as well as possible under water and a 4½-foot thick concrete plug was placed in the bottom by the tremie method. Once the tremie plug had set it was a simple matter to dewater the caisson and construct the remaining portions in the dry. There was no sheeting or well pointing necessary and the entire operation proceeded smoothly.

The interior of the pumping station is divided vertically into two compartments with separate entrance hatches and stairways. One side contains the wet well and above that the comminutor room. The other side consists of the pump room with the motor room above. Aluminum entrance hatches and steel stairs were used in place of manholes and ladders for ease and safety of inspection. Both halves of the station are continuously ventilated by 8-inch exhaust fans and air intake ducts.

The pumps used in the pumping station are vertical, dry-pit, nonclog sewage pumps. Pump control is automatic by means of a float actuated controller responding to a rising or falling of wet well water level. Since some provision would have had to be provided at the treatment plant for screening of the sewage in any event, a comminutor was installed ahead of the pumps. The comminutor effectively cuts large rags and solids into small pieces and greatly reduces the chances of one of the pumps clogging.

The pumping station receives power from two separate sources to minimize the possibility of pump failure due to power outage. However, if for any reason the pumps are not able to keep up with the incoming flow, the rising water level will activate an alarm bell. The station is so designed structurally and electrically that the wet well section could completely flood with sewage to the elevation of an overflow pipe to Sprout Brook without in any way affecting the other section of the station.

The contractor for the pumping station was Jos. L. Muscarelle, Inc., who was also the general contractor for the Plaza proper. Pumps were furnished by the American Well Works Corporation and the pump controller is a Healy-Ruff Rototrol unit. The comminutor was furnished by the Worthington Corporation. The sewage pumping station was designed by Hazen and Sawyer, and the design of Garden State Plaza itself was by Abbott-Merkt, Architect-Engineers.

RECORDS ASSIST PARKING METER MAINTENANCE

DONALD O. TOWNSEND,
Chief, Dept. of Electricity,
City of San Francisco, Calif.

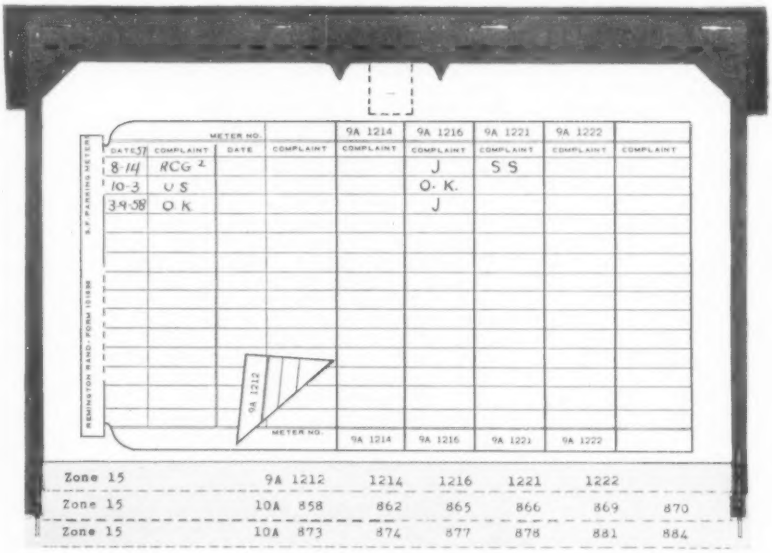
PARKING METERS have probably become one of the most unpopular necessities administered by medium and large cities. Too few auto owners realize, as they grumble about dropping their pennies into a meter, that there would probably be no parking space without the meters to promote movement in downtown areas.

By the same token, only the city or town officials involved have any inkling of the care which must be observed to keep them functioning —from the actual business of repairing faulty timing mechanisms, right on through to keeping the records which make it all possible.

Within the city limits of San Francisco are the most heavily populated areas in the West. This, of course, results in the inevitable traffic problem. In fact, we are believed to have the largest number of parking meters, per capita, in the country. The rapid growth of meter installations has added to the administrative and maintenance problems which might normally have been expected.

We installed our first parking meters, about 550 units, in 1947; one decade later, we had 12,600 in operation. By 1956, meter revenue picked up by the City Collector's Office came to $945,000 during the year.

Obviously, to be of any value either in easing traffic problems or from the point of view of revenue, the meters must be kept working. This fact in itself has become an operation of major proportions. For example, we are currently filling some 50,000 service calls per year. Between 1,600 and 2,000 meters per month are deliberately jammed by the public. In one recent month there were 4,412 service calls. It takes a staff of 15 service men to keep up with maintenance, with an additional two-man crew kept busy full-time just in removing and installing, and repairing physical damage such as bent or loose posts.



● **RECORDS for up to six meters are kept in each Kardex pocket. Code numbers show exact location of each meter, while letters cover such complaints as: RCG² = Replace Coin Glass (2); J = Jammed; SS = Stuck Signal; and US = Unwound Spring.**

● **KEEPING records on 12,600 parking meters in use in San Francisco is a job that is made comparatively easy by the use of Kardex records and Chaindex inserts.**

Within the framework of the City government, this job was logically turned over to the Department of Electricity, which already had a working shop, and was experienced in both the manufacture and maintenance of precision equipment. One of the jobs handed the Department, some 34 years ago, was the manufacture of the first traffic signals used in San Francisco. Today, we provide maintenance and operation for the fire alarm system, traffic signals, police telephone and radio equipment and air raid sirens. With our facilities, we naturally inherited the parking meters when they were installed.

Adequate Control Records

Obviously, in a job of this magnitude, adequate control records are essential. The first 550 meters, of course, posed no problem. They were ordered numbered consecutively, and were installed consecutively up one side of the street and down the other. A listing was made on ledgers, with columns on which we could record service activity. Within a few years the meters had grown to 5,000, and the ledgers were swamped.

In this connection, it might be noted that standardization on one parking meter—minimized the early growing pains. We realized, however, that unless we solved the record-keeping problem adequate maintenance would be impossible. Our decision to adopt Remington Rand's Kardex system was arrived at partly with one eye on the future, because of its ability to grow as needed. We developed a method for locating and identifying meters which has stood the test of time, and completely fulfilled its function.

We assign numbers according to location, so that we can tell through the number right where it is. The first three numbers or letters are an abbreviation of the street. For example, if the meter were located on Market Street, it would begin with MKT; 18th Avenue would begin 18 A; 18th Street, (we have both) would be 18S. The remainder of the number is the address of the building closest to the meter.

When the Kardex record was set up, five columns were listed on each card in the individual pocket, controlling five meters per card. These were set up consecutively by service territories; today, there are three Kardex slides for each territory.

Almost as quickly as this system was put into operation, however, it was made inoperable. Granting, revoking and altering various curb zones necessitated by changing conditions plays havoc with meter locations. Then, too, the heavy rate of construction has forced us to remove meters while work is underway, and replace them again later on. It became impossible to handle multi-meter listings on one record card.

What we did was to "expand" the Kardex system. Chaindex cards were designed for us which made it possible to utilize separate controls for up to six meters in one pocket. These cards are die-cut to fit one under the other, and can be removed as often as necessary without affecting the other cards in the pocket. Within the same Kardex cabinets, therefore, we were able to expand the system by fully 20 percent.

As set up today, three Kardex slides contain the records covering a complete service route. At the end of the grouping are cards on which are entered pending service calls, and particularly emergencies such as broken or bent posts.

As calls come in, the clerk who acts as dispatcher for the service staff notes the meter location and complaint. The men pick up their assignments in the morning, or as they call in during the day. They, in turn, make out a report of work accomplished.

These reports are turned in to the clerk, who enters the essential facts on the records. He notes the date on which work was done and, using a code, the nature of work. J, for example, will mean the meter had been jammed; LP stands for loose pole; SS is stuck signal; etc.

The visible Kardex record permits past posting and reference, and speeds what might otherwise be a time-consuming transcribing job. Each pocket has a visible edge at the bottom, with a title insert carrying the meters it controls showing at all times. A quick glance down a slide leads the clerk quickly to the pocket he wants; flipping it open, he finds the card controlling the meter on which work was performed.

Damage Patterns Traced

The importance of this system extends beyond the obvious job of telling where each meter is located, and what its history has been. As one example, the Police Department has assigned a detective to work on violations. Utilizing the records, we have established damage patterns, noted the presence of particular cars in the parking areas involved etc. Tracing such clues down, some 300 arrests have already been made.

Actually, because they have to do with law infringements, these service records have become a law enforcement tool. They have provided information required by the traffic court. Also, because they are strictly impartial, and completely accurate, they assure that complaints by the public are given fair treatment. When a call comes in, the record is immediately checked, and if there have been no calls on the meter for four days a serviceman is sent out.

They are, of course, essential to our preventive maintenance program. The clock mechanism in every meter is pulled out and overhauled every 18 months. Routes are worked according to the records, which are noted to insure that the overhaul was completed.

As most, if not all, municipal officials will acknowledge, parking meters have become an operating necessity in the middle of the Twentieth Century. No less essential, from the administrative standpoint, are operating records which provide the quick reference, flexibility, and expandibility to provide essential service and grow with the times.

REMOVAL, TRIMMING and PLANTING of ROADSIDE TREES

W. J. BURMEISTER,
Engineer of Maintenance,
State Highway Commission of Wisconsin

A CONFLICT of interests between state highway departments and abutting property owners often arises when the highway maintenance engineer determines it is necessary to remove a tree from the roadside near the owner's home. There is also conflict with other groups and agencies interested in conservation, roadside cover, and related fields and, from time to time, they question the necessity for removing or trimming trees along state trunk highway right-of-way.

The State Highway Commission of Wisconsin has long recognized the necessity for carrying out a sound program of tree removal and trimming along the right-of-way based on logical reasoning and a desire to cooperate with private owners and other interested groups insofar as our maintenance responsibility to the traveling public permits. Indiscriminate cutting of roadside trees by either our maintenance forces or by private utilities is prohibited and we try to confine all cutting of trees to those situations dictated by necessity.

A situation wherein we consider removal of a certain tree or trees to be necessary is the result of safety considerations and generally would consist of one or a combination of the following cases:

1) In such proximity to a live traffic lane that there is a potential traffic hazard, particularly in the event of a vehicle leaving the roadway for any reason.

2) In such a location on the south side of the road as continuously to shade the traffic lanes in winter, thereby causing an icy spot when the remainder of the road has been cleared of ice or snow.

3) In a location near an intersection, private driveway or other access point such as to obscure vision for traffic entering or leaving the highway. Similarly, heavy foliage on the inside of a curve might also obscure or obstruct vision for vehicular traffic using the highway.

● **DEAD and partly broken tree presents a hazard to motorists since it is close to the edge of busy highway.**

4) Trees which are dead, overmature, or of such a type as will splinter or break easily in high winds, causing limbs or perhaps the entire tree to fall onto the roadway, resulting in a serious and dangerous obstacle to traffic.

5) Where there is apt to be interference with either new construction or maintenance work on the highway. It often becomes necessary in the course of reconstructing a highway to remove large numbers of trees. However, considerable effort is made to save those trees which are not actually within the construction limits, and which would not interfere with future maintenance operations on the new highway.

Such tree removal as becomes necessary under the above conditions is generally done by our highway maintenance forces consisting of county highway patrol crews. Normally crews consisting of two to five men are used on tree cutting work, depending on the number, size, and location of trees to be removed and the degree of traffic control deemed necessary during cutting operations. Cutting is generally done during the winter season when the county crews are not engaged in snow removal or ice control work, or are otherwise required by storm damage or other emergency conditions.

The equipment used consists generally of patrol trucks, power saws, cross cut saws, axes and the usual

● **POOR vision at a curve can contribute to motoring hazards. Trimming back the trees interfering with full vision and cutting brush extends motorists' sight distance.**

miscellaneous tools normally used for cutting down trees. In some cases it becomes necessary to utilize heavy equipment and cables to direct properly the fall of a tree away from the roadbed and public utility facilities. We have been quite successful in enlisting the aid of public utilities when the trees to be removed are near their transmission lines or other facilities.

The tree once it is felled is trimmed and cut into reasonable lengths for handling. The limbs are hauled away and disposed of and the logs either hauled away or given to the property owner if he desires the wood. Stumps are left in the ground if the tree can be close cut and the remaining stump will not cause a potential hazard to traffic; or they are completely grubbed out if the particular location warrants such action.

In addition to the safety considerations, tree trimming and pruning is done, as time permits, for the sake of improving roadside and individual tree appearance and generally in order to accomplish one of the following:

1) To open scenic vistas to the traveling public. When trimming for this purpose is done the opening should extend for a distance of 400 to 500 feet along the highway. We feel that such a distance is necessary in order to permit more than a mere flashing glimpse under modern conditions of high speed travel.

2) To trim weak or misshapen branches, prune sucker branches and better to shape a young roadside tree and promote its full and satisfactory development to maturity.

3) To trim and cut selectively in heavy stands of trees which are so close together as to crowd each other and to restrict proper growth.

The limbs and debris from trimming operations are disposed of off the highway right-of-way by the county highway trimming crews. Trimming is generally done in the winter season as time permits, except that emergency trimming and cutting are done as required.

Dutch Elm Disease

One of the great threats to a large number of roadside trees in Wisconsin is the current invasion of the Dutch Elm disease. At the present time the disease has not penetrated very far into the state. However, we recognize that its spread can be quite rapid if not controlled, and we have initiated steps for such control. All current highway construction and maintenance contracts and permits in this state contain a special provision to the effect that all elm logs, stumps, bark, windfalls and debris encountered within clearing and grubbing limits or by any cutting or trimming under permit shall be disposed of by burning or burying or in lieu thereof by debarking and salvaging of logs and burning or burying the bark and other debris. The general maintenance cutting and trimming of roadside elm trees is conducted in accordance with the same sanitation practices which we have found effective.

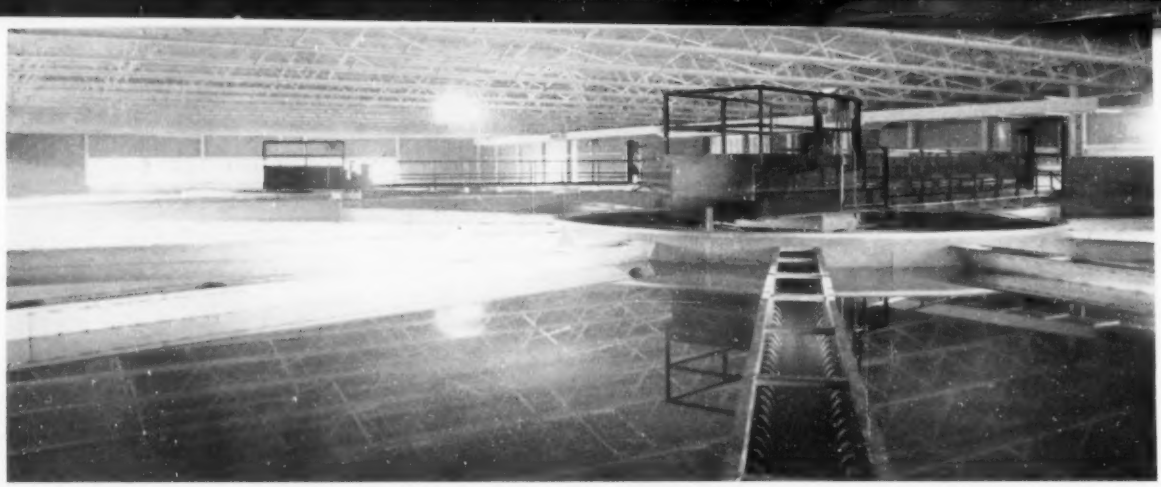
Our maintenance supervisors in the field are constantly on the alert for elm trees which appear to be diseased. Samples from such trees are promptly tested for presence of the disease, and if the tree is proven to be infected, it is promptly removed and disposed of. The spread of Dutch Elm disease along our state trunk highways has not as yet been extensive enough in Wisconsin to warrant insecticide spraying of elm trees as an additional sanitation measure. We are reluctant to set up a spraying program because such spraying can and has caused considerable damage to desirable insect and bird life.

● **TREE that was too close to the edge of the highway has been felled. County crew is cutting it up for removal. Use of power tools greatly expedites the work.**

● **RESULT of trimming trees and cutting back brush shown in picture on opposite page. The sight distance has been extended and highway safety materially improved.**

The planting of trees along our highways is done under the supervision of our Roadside and Landscape Section and is more or less confined to the newer highways with relatively wide rights-of-way. We feel that planting new trees to replace those removed from old narrow roads is impractical for two reasons; first of all, the newly planted tree would in a few years constitute the same potential traffic hazard that necessitated removal of the old tree. Secondly, the older highway is usually a candidate for reconstruction and during that reconstruction it would undoubtedly be necessary to cut down the new trees. We therefore plant new trees only at locations along the outer

(*Continued on page* 208)



● INTERIOR of treatment building housing the Reactivators. Structural members of ceiling are reflected in foreground.

MICHIGAN'S LARGEST HIGH-RATE WATER TREATMENT PLANT

VERNON L. HINEBROOK,
Superintendent of Water Department, Highland Park, Michigan

and

JOHN L. SCHEID,
Assistant Manager, Municipal Water Treatment, Graver Water Conditioning Co., New York, New York

WHEN Henry Ford came to Highland Park, Mich. in 1910, he found a midwestern village with a population of about 4,120 and no heavy industry to speak of. Ford created a minor revolution in the town by setting up his manufacturing headquarters there. His company was later joined by Chrysler. These giant industries naturally put great strains on the community water supply. Population growth also contributed to the demand for more water, as did the increased use of air conditioners and other appliances. A direct result of these conditions is the new high-rate water treatment plant recently put into operation.

Highland Park is a city within a city, completely surrounded by Detroit. When it was incorporated as a village in 1899, water was supplied locally. Later, Detroit was the supplier, but in 1913 Highland Park embarked on its own water system. For this purpose, it was decided to draw water from Lake St. Clair, about 13 miles away, and the rights to a pumping station which had been built by the Detroit Edison Company were purchased. A 30-inch cast iron pipe, 11.6 miles long from the pumping station to the town, provided a 16-mgd capacity. Later, a rapid sand filter plant, a clearwell, an elevated tank and various raw water reservoir basins up to 45 mg capacity were installed at the water treatment plant. After a time one of the small basins was converted into a conventional settling plant with alum feed and chlorination before filtration. Meanwhile, in 1918, Highland Park was incorporated as a city.

The Highland Park system was quite adequate to meet all needs until the end of World War II. Then, in spite of the fact that the city was almost entirely built up, demand began to rise at the rate of 3 percent a year. By 1955 there were peaks of 20 mgd, with industry using 60 percent of the water. Because of slime build-up in the raw water line and other problems, only 13 mgd could be delivered to the plant for treatment. Although scraping of the piping brought the flow up to 16 mgd for a time, eventually the capacity would go down to 13 mgd again. In addition, the old mixing basin and settling chamber could not meet the demands placed on it. A new plant was indicated and the city water department made a study of available treatment methods.

New Plant Plans

In 1955, the water department was ready with a proposal. This called, first, for the construction of a booster pumping station mid-way between the lake and the treatment plant. This would compensate for the small size of the raw water line and would raise capacity by 40 percent. Next it was recommended that the town be provided with two 11-mgd high-rate clarifiers which would operate on a continuous basis; simultaneously in summer when demand was high and alternately in winter when demand slacked off.

High-rate units were specified because space for a conventional 22-mgd settling basin would have been costly and also would have necessitated location some 2000 feet from the filter plant. The high-rate units were also more economical on an installed cost basis; and, the water department felt that water flowing in contact with septic sludge would not be as palatable as water treated in a unit where sludge was removed frequently. Results bore out this contention. The units selected for clarification were Graver Reactivators®, which not only provided for continuous sludge removal, but did it automatically. Another recommended change included the conversion of a reservoir into a clearwell. The department's plan was approved and construction began in the latter part of 1955.

Plant Details

The main components of the new system are housed in an insulated aluminum exterior building. This structure is 160 ft. x 80 ft. and is attached to a smaller building measuring 91 ft. x 28 ft. which houses the chemical equipment and storage. In the larger building are the two Reactivators provided by the Graver Water Conditioning Co., each of which measures 80 ft. sq. x 21 ft. 6

inches high; and three 3600-gpm 20-foot TDH centrifugal pumps that transfer water from the adjacent reservoir. The Reactivators extend over the entire length of the building and thus make use of 3 building walls, but are separated by a common wall, features contributing to the economy of construction. The pumps and valves in the building are remotely controlled from an adjacent lift pump station.

In the chemical building are storage facilities for 7000 gallons each of liquid alum, carbon slurry and coagulant aid. Chemicals are fed by controlled volume pumps in the building which are regulated from the filter plant by remote control. The new buildings put the main part of the plant above ground, unlike the old system, so that its operation can be readily observed.

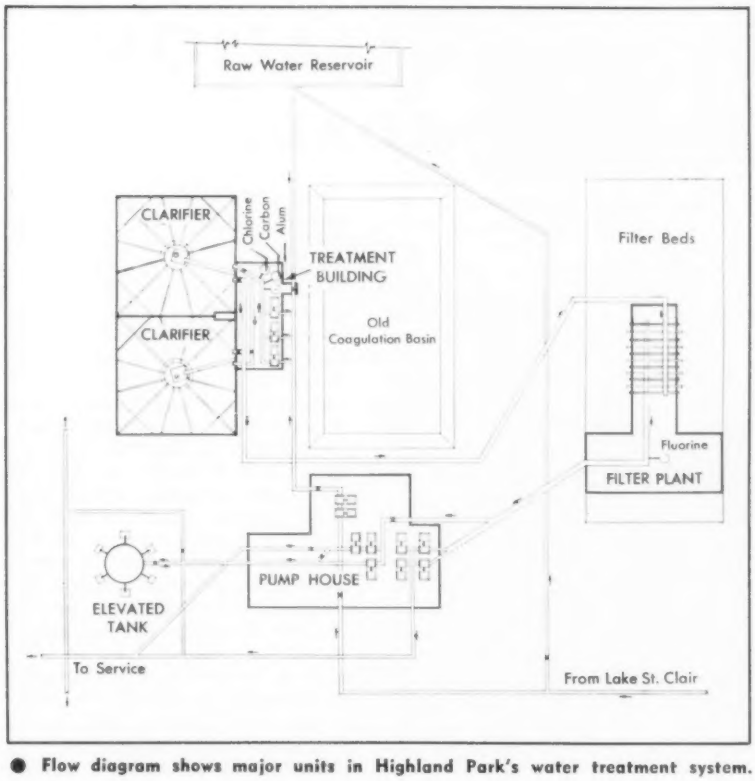
The Reactivators have steel internals and all concrete shells. They provide for flocculation, sedimentation, clarification and sludge removal in a single compartmented tank; and being an up-flow solids-contact type unit, operate on the principle of preformed floc. This is ideal for the water being treated from Lake St. Clair which forms very light floc and requires good thickening for effective removal.

Each unit has complete desludging equipment including sludge spider, sludge header to the sump, blowoff and backflush valves, timers and solenoid operated diaphragm valves. Sludge is removed from the bottom of the unit by scrapers which sweep over the entire bottom area, and blowoff is automatic. The sludge impeller shaft is operated by a ½-hp motor.

Courtesy The Highland Parker

● **NEW treatment building at Highland Park, Michigan, has exterior walls of fluted aluminum. Structure houses two 11-mgd Reactivators and measures 80 x 160 ft.**

Close to the new building is the filter plant which was installed in 1921 and at that time was one of the first such plants in the State. The filters are in excellent condition; however, it was felt that an improved underdrain might help operations. It was decided to install in one of the filters a new type underdrain developed by Graver Water Conditioning Co. This is designed for easy adaptation to all types of filter units. Highland Park is the first installation incorporating it. Unlike most underdrains, this one is of corrugated asbestos, which is both light in weight and non-corrosive. The corrugations form the laterals. The 4½-inch deep underdrain is drilled to receive bakelite ferrules. No piping or leveling is required so that it is easily installed. The underdrain is preset, ready to be placed in the grout. Uniform distribution is assured because of the proximity of the orifices. Up to the present, this underdrain is operating very satisfactorily. It may be installed in all the filters later on.

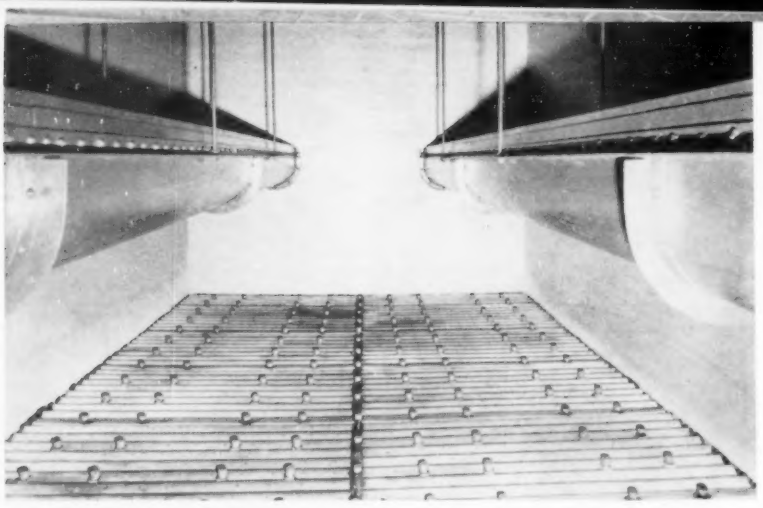


● **Flow diagram shows major units in Highland Park's water treatment system.**

Operation

The water being treated from Lake St. Clair has average turbidities of 6-7 ppm, a lower range of 1-2 ppm and a high during the spring and fall of 100 ppm. The water contains silt and occasionally plankton. The clarifiers are designed to remove a minimum of 95 percent turbidity in the normal and high ranges, with turbidities not to exceed 0.5 ppm in the effluent from the Reactivator.

Water is pumped through the 30-inch raw water line from the Lake by one or more of six centrifugal, electrically driven pumps of different capacities, ranging from 7.5 mgd to 9.7 mgd at a pressure of 95 psi.



● **NEW TYPE of underdrain made of corrugated asbestos was installed on one of the filters. Small holes in surface are orifices. Rows of anchor bolts can also be seen.**

Water then goes to the booster station where it enters at a pressure of 45 psi. It is discharged at a pressure of 90 psi by one or more of three 7300-gpm pumps. Pumping operations are regulated by a telemetering system controlled from the filter plant.

At the treatment plant in Highland Park, water can be fed directly to the Reactivators or all or part can be passed to the 45-mg reservoir. Water can also be taken from the reservoir to supplement water being fed directly to the clarifiers. In the Reactivators, the water is treated with 1.5 ppm of 23 percent commercial liquid alum and 1 ppm or less of coagulant aid. It is anticipated that the coagulant aid will not be required in the higher turbidity ranges. After rapid mixing, floc is formed and settled sludge is blown off automatically. Clarified water flows by gravity to the filter station 200 feet away.

Rate controllers on the filters are set to about 3 gal./sq. ft. per minute. Water is collected in a 3-mg clearwell and flows by gravity to the adjacent high lift pumping station where two or more of seven electrically driven centrifugal pumps with capacities of from 4 mgd to 10 mgd send it out to service. Water is also stored in an elevated tank which floats on the line. The city's distribution system consists of about 56 miles of cast iron mains, ranging from 6 inches to 24 inches in size; of these over 25 percent are 12-inch or larger. A uniform pressure of 48-50 lbs. is maintained throughout the city.

Thus far the Reactivators have been operating on water with turbidities of from 2-15 ppm. Removal has been excellent and turbidity in the settled water has averaged 0.3 ppm, compared with 0.8-1.9 in the old basin. Because of the clarity of this water, a great improvement has been observed in filter runs, which have been doubled and in some cases tripled. The percentage of wash water has been cut by half or more. Filter runs now stand at a maximum of 100 hours. In the old plant during periods when plankton was present, runs were cut to 9 or 10 hours. Now they are up to 30-46 hours during such periods.

SALT-SOIL STABILIZATION *on* TOWNSHIP ROADS

WILLIAM A. SOMMERS,

Township Manager,
Bensalem Township
Cornwells Heights, Pa.

BENSALEM Township is caught up in the vortex of metropolitan growth that has swept through lower Bucks County, Pennsylvania, since 1950. Located on the northeastern border of the city of Philadelphia, the township is experiencing the complex problems of being part of bulging suburbia. In 1957, a special federal census was taken which showed that the township population had nearly doubled since 1950. Then, it was 11,365; now it is 21,858; and there is no end in sight.

One of the major problems stems from the increased traffic load which the predominantly rural and residential streets must bear. Not only has through traffic been increased tremendously with the addition of the Delaware River section of the Pennsylvania Turnpike and the suburban traffic on U. S. Routes #1 and #13, but intra-township travel has also increased beyond expectation. This heightens the never-ending problem of road maintenance. Nor is this all. The township has an area of nearly 22 square miles and the areas of population growth are widely scattered with built-up areas broken up by large areas of rural and semi-rural land use. The job of maintenance is divided between the problems of residential streets and those posed by rural roads and farm-to-market connections. Most of the existing roads do not have adequate bases, having been once rural roads or small residential streets built on untreated soil and maintained for years by the use of frequent surface treatments of tar and stone chips.

While the problems multiply, the tax resources are not sufficient to cope with them in a manner indicated by the needs. As is common in similar suburban growth, the largest share of the tax dollar goes to support schools. Out of a total levy of 84 mills, 65 mills goes for the school district, 8 for county functions and 11 for the township. Out of the latter must come funds for police, volunteer fire department contributions, building and zoning inspectional services, administrative functions, street lighting, miscellaneous expenses and last, but by no means least, road maintenance. The township also holds an unique position in Bucks County, being the township with the largest amount of tax exempt land. At latest count over 30 percent of the total valuation is exempt from taxation while, from the county point of view, 26 percent of all such land in the county is located in Bensalem Township.

The 1958 road budget for the Township is set for $140,000, with about $35,000 earmarked for contract

construction. The road crew consists of 10 men and a road superintendent working with three 1953 Chevrolet trucks; one 1957 Galion 303 grader; a 1957 Minneapolis-Moline tractor with an Ottawa frame supporting a ¾-ton front end loader; and a ten-ton, three-wheel steel roller. This crew and equipment must maintain 82 miles of road, many miles of irregular drainage ditches and hundreds of cross pipes, as well as doing traffic and street sign erection. Of the 82 miles of road approximately 15 are of dirt. There is no storm drainage except in three new subdivisions constructed since 1953. These latter are the only areas that also have curbing, sanitary sewage and public water. With such a lack of proper drainage, storm and sanitary, and equal lack of curbing, maintenance is quite a chore. It is even more difficult on the dirt roads.

The township supervisors have also embarked on a program of taking over many unimproved streets that have been in dispute for years because of the lack of proper subdivision regulations and street standards.

Under these conditions it is not difficult to see why salt-soil stabilization is being used as a possible aid in maintenance work. Rock salt when properly mixed with soil having a good clay content (not less than 25 percent) and aggregate under 1½-inch will hold together quite well because of salt's ability to keep moisture in the blend. It will also act as a cold weather preservative by reducing the temperature for freezing and thus preventing extensive break-up and the other evils that cold weather contributes to rural, gravel roads.

To test salt as a stabilizing agent a rural road was rebuilt with this type of approach. The road chosen was a rural one, running through a farming area, but it also serves as an important link in a system of township roads which in turn connects two main state highways traversing the township. At one end of the road is a growing community whose people make good use of the road as a short cut to the central areas of the township. It is about one-half mile in length with an average width of 20 feet. For estimating and cost purposes the figure of 6000 square yards was used. With the approval of the Board of Supervisors of Bensalem, Salt Service Company of Philadelphia, a distributor for Cayuga Rock Salt Company of Myers, New York, was designated as the supplier of the salt. The par-

● **ON BENSALEM Township project, after the roadway had been scarified and rough graded, aggregate was added and 25 tons of bagged salt were dumped along the road.**

● **WINDROWING moves aggregate into salt and clay. Two motor graders were used for this operation and the windrow was shifted 5 or 6 times to get a complete mix.**

● **DURING compaction it was necessary to add water to maintain optimum moisture content. An adequate nearby water supply is desirable on any stabilization project.**

ent company also provided valuable assistance in directing the construction operations. In addition, Penn Valley Crushed Stone Company of Fallsington, Pa. was given the job of supplying needed aggregate.

Construction Procedures

Road crews first closed the road to traffic and then began scarifying and blading the existing roadway. It was the aim of the project to end up with a compacted base course of approximately 5 inches which was, in turn, to be made up of an equal combination of in-place material, consisting of soil with a high degree of clay content, and aggregate which was crushed gravel, screened to sizes of ¾ to 1⅛ inches. During the scarifying and blading process road workers picked out large stones which would cause break-out trouble if included in the final mixing. The soil taken off the road was windrowed on either side of the road by using the Galion grader with a 10-ft. blade. A 30-hp Caterpillar grader was borrowed from neighboring Bristol Township where Henry J. Rolfes is the township manager. Scarifying was done largely by using the row of teeth on the back of the ten-ton roller with the teeth set for a 6-inch cut.

25 tons of bagged salt were then placed in position. The 100-lb. bags were broken open and scattered. The salt can be spread by an open tailgate with a fixed opening or by using any one of a number of salt and material spreaders. Our newly acquired Tarco Scotchman will no doubt be used on the next salt project. At the same time the salt was being placed in position, the crushed gravel was being dumped and spread slightly to the side of the road crown. Although the road had generally sufficient clay content, some sections which appeared dubious received a load or two of soil with high clay content taken from a nearby clay pit.

Mixing the Materials

With all the materials in place, the two graders then proceeded to windrow all the materials five or six times to obtain optimum mixture while all the time shaping the roadway to the desired crown and fall. It should be noted that while graders were used to achieve the mixing, where it is possible and feasible to rent or borrow a pulvi-mixer, the latter should be used and will not add much to the ultimate cost. As each section of the road received its final blading and grade, township trucks were driven slowly up and down the finished portion to compact the material and finish off the roadway. Though the use of trucks is recommended, again, if a self-powered pneumatic tire roller is available this will no doubt increase the efficiency and lessen the time consumed in the compacting process. Although a great deal of rainy weather was encountered during the work on the project, it was still necessary to keep on hand and in action a water tank mounted on a township truck to wet down each portion before and during the final rolling. The tank was lent the Township by Bristol Township. However, water supply did present somewhat of a problem. Since the township building is supplied by a well and is equipped with a regular size domestic pump, water could not be had in sufficient quantity to fill the tank. Other sources of water required longer travel distances. Fortunately, a farmer on the road had an irrigation pump attached to his well for crop watering and allowed the township to use his pump.

Compaction

After the trucks had rolled the surface to sufficient compaction to provide the 5-in. base, the ten-ton steel roller was used to finish the rolling and to smooth down any latent tire ruts. The road was then allowed to set unused for a day or so. Then a crew went over it, mixing additional clay and salt in with any outcroppings of gravel that may not have been thoroughly mixed during the initial process. Afterward, the completed surface was given a treatment of calcium chloride. It is the aim of the salt-soil stabilization process to achieve a thorough mixing of all three elements resulting in the aggregate being bound together by the clayey soil while salt, spread equally throughout the mix, holds moisture to the clay and thus perpetuates the binding effect on the aggregate. The surface, being exposed to the air, should become hard with the soil filling in the voids throughout the distribution of the aggregate.

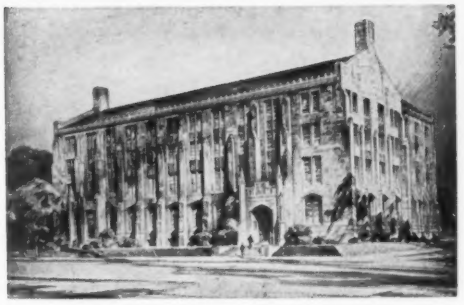
The finished road will stand for one year and next season a surface treatment will be applied using a regular mix of tar and stone or slag as is used in this area. The road should then have a better than average life with a good base, surface sealing and decreased maintenance. Moreover, the salt, even without any surface sealing, will provide a road that does not need constant grading and addition of aggregate nor will it have the continual "potting out" that is the bane of most dirt roads. Already, next year's road program is being planned with several miles of dirt roads being designated for salt-soil stabilization.

Cost figures on the project are not altogether representative because of the use of a large amount of aggregate; the labor costs which can easily be lessened as experience in this type of work is greater; and the desire on the first project to achieve a greater than necessary base preparation and depth. However, they still represent a substantial savings in base preparation as well as an economical achievement in the resulting road surface. The cost calculations are as follows: Labor: 2½ days @ \$150 = \$375; equipment: 2½ days @ \$300 = \$700; and material: 25 tons of rock salt @ \$22 = \$550 and 250 tons of aggregate @ \$1.75 delivered = \$437.50. The total cost was \$2062.50.

Unit costs were \$0.34 per sq. yd. per 5-in. compacted base and \$0.065 per sq. yd. per inch of compacted base. In the figures used for equipment rental the contractors' standard of \$10 per hour was used. Material units will, of course, vary depending on the clay content, the in-place aggregate and the base depth to be achieved.

● **COMPLETED road, photographed the day after one of the year's worst flash flood rainstorms hit the area, indicating weather resistant feature of pavement.**

News BULLETINS



AMERICAN PUBLIC WORKS ASSOCIATION, 1313 EAST 60th STREET, CHICAGO 37, ILLINOIS

Winnipeg's City Engineer Becomes First Canadian President of APWA

The membership of the American Public Works Association recently elected William D. Hurst, City Engineer of Winnipeg, Manitoba, Canada to be President of this fast-growing organization. Mr. Hurst, who is the first Canadian to hold this important office, took over the reins of the Association from Sol Ellenson, Director of Public Works of Newport News, Va. at the close of the APWA's 64th annual meeting which was held in Kansas City, Mo., September 28-October 1.

Mr. Hurst

Mr. Hurst has been a member of the APWA since 1944 and is widely recognized as one of Canada's most outstanding public servants. He was elected to the Association's Board of Directors in 1955 and was elevated to the post of Vice President in 1957. He was also instrumental in organizing the Manitoba Chapter of the APWA.

Another highly respected public official, Jean Vincenz, Director of Public Works for San Diego County, California was elected Vice-President of the Association. Mr. Vincenz previously served as Director of Public Works of Fresno, and has been a member of the APWA since 1936. He has served two 2-year terms on the Association's Board of Directors, first, in 1953-54 and again in 1956-57. Mr. Vincenz helped to lay the groundwork for the establishment of the Association's San Diego-Imperial Counties Chapter and is widely known in the sanitation field as a pioneer in the development of the sanitary landfill method of refuse disposal. That he is a progressive minded public official is evidenced by his return to school after completing over 40 years of government service to earn a master's degree in public administration from San Diego State College.

John A. Morin, Superintendent of Streets and Ex-Officio City Engineer of Oakland, California was elected to serve a two-year term as Director of Region Eight. He has worked for the City of Oakland for over 15 years and was appointed to his present position in 1953. Mr. Morin joined the APWA in 1949 and has been very active in the Association's Northern California Chapter and recently completed a term as its President.

The newly elected Director of Region Nine is William A. Bowes, who has headed the Department of Public Works of the City of Portland, Oregon, since June 1, 1939. He was President of the League of Oregon Cities in 1951-52 and has been a member of the APWA since 1941. He also served a 2-year term as a member of the Association's Board of Directors in 1947-48.

Louis H. Moehr, City Engineer of Wyandotte, Michigan, is the third new member of the Association's Board of Directors. He was elected to a three-year term as Director of Region Five. Mr. Moehr joined the APWA in 1948 and became President of the Michigan Chapter in 1954.

Other members of the Association's Board of Directors are: Charles W. Cooke, Director, Greater Hartford Flood Control Commission, Hartford, Conn.; Frederick W. Crane, General Manager, Buffalo Sewer Authority, Buffalo, N. Y.; Robert Hopson, Director of Public Works, Richmond, Va.; Albert G. Wyler, Director of Streets, New Orleans, La.; Edward J. Booth, City Engineer, Bismarck, N. D.; H. H. Hester, Street Superintendent, Fort Worth, Texas, and Immediate Past President Sol Ellenson.

APWA Issues New Manual on Refuse Collection Practice

Chicago, Ill.—The first revision of *Refuse Collection Practice* published originally in 1941 is now available for distribution. The 550-page cloth bound book, prepared by the Committee on Refuse Collection of the American Public Works Association, has been published by the Public Administration Service, 1313 East 60th Street, Chicago 37, Illinois. The book, a practical manual on the municipal refuse collection problem, contains numerous photographs, charts, diagrams and tables for ready reference. It also contains an extensive index, selected bibliography, cost data, typical ordinances, and tabulations of practices. It includes separate chapters on the general problem; refuse materials; preparation of refuse for collection;

OFFICERS: Wm. D. Hurst, Winnipeg, Manitoba, Canada, *President;* Jean L. Vincenz, San Diego, Calif., *Vice President.* REGIONAL DIRECTORS: (term ending 1959) Albert G. Wyler, New Orleans, La.; Edwin J. Booth, Bismarck, N. D.; Frederick Crane, Buffalo, N. Y.; (term ending 1960) Charles W. Cooke, Hartford, Conn.; R. S. Hopson, Richmond, Va.; H. H. Hester, Fort Worth Tex.; (term ending 1961) Louis H. Moehr, Wyandotte, Mich.; John A. Morin, Oakland, Calif.; W. A. Bowes, Portland, Ore. *Immediate Past President,* Sol Ellenson, Newport News, Va. Robert D. Bugher, *Executive Director*

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LOOK AT THIS COMPARISON:*		Hobbs Hydepak Model 1619	Body G	Body P
	Body Volume, cu. yds.	16.2	12.7	12.9
	Empty Weight, lbs. (including weight of trucks)	12,180	13,740	12,280

*Measurements by an independent testing laboratory for a major Southwestern city.

Simple arithmetic shows you from the above how four Hobbs Hydepaks can do the work of five other units of similar weight and cost. You save the cost of an entire unit, crew, fuel, maintenance and insurance — *and* you reduce costly trips to the dump site!

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factors affecting costs; methods of collection; equipment; planning; supplemental transportation; special problems; municipal, contract or private collection; financing; organization; equipment management; cost accounting and budgeting; personnel (including employee relations) and public relations.

The committee was appointed in April 1955. Work was begun by developing a plan of procedure based in large part on the use of questionnaires to obtain the necessary information on current practices from the various cities. The committee recognized the difficulties of obtaining reliable and accurate data for comparative purposes through this method. However, it represented the only economically feasible method of procedure, and it was felt that information of real value to those working in this field could be supplied if the collected data were carefully interpreted. The survey was carried out in two phases. The first consisted of forwarding a questionnaire to all cities in the United States and Canada having more than 5,000 population. The second phase was the forwarding of a more detailed questionnaire to over one hundred cities selected by members of the committee, as representing in the opinion of the committee members, a group which would be better able to provide more accurate and more complete operational, quantity and cost data.

Of the general questionnaire mailed to all cities over 5,000 population, 908 or about 38% were returned for analysis. Of the 125 comprehensive questionnaires mailed to selected cities, 89 were returned. In the latter group replies received included cities ranging from a population of 13,000 (Winnetka, Illinois) to over 8,000,000 (New York City) located in 34 states plus the District of Columbia. All data reported is 1955 or later.

The U. S. Public Health Service cooperated by providing technical assistance, particularly in the tabulation and analysis of the data contained in the returned questionnaires.

The Refuse Collection Committee of the APWA consists of Warren A. Schneider, Chairman, Director, Bureau of Sanitation, Department of Public Works, Los Angeles, California; Ralph C. Taylor, Superintendent, Waste Collection Division, Department of Public Works, Cincinnati, Ohio; Theodore C. Eppig, Deputy Commissioner, Department of Streets and Sanitation, Chicago, Illinois; Henry L. Giles, Deputy Di-

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...CONSOLIDATES THE BULK

...LESSENS DUMPING OPERATIONS

...REQUIRES MINIMUM MAINTENANCE

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September 24, 1956

Mr. W.O. Forman, President
Fitchburg Engineering Corporation
Fitchburg, Massachusetts

Dear Sir:

This is the second year our Fitchburg Chipper has been in service. We are very well satisfied with its performance.

It steps up our brush removal program. It consolidates the bulk, thereby lessening dumping operations. It requires minimum maintenance and manpower.

During the 1955 hurricanes and floods, we found it especially beneficial in disposing of branches and limbs of trees, thus speeding up the opening of the highways.

Very truly yours,

Edmund V. Carlos

Edmund V. Carlos, Supt.
Northwest Division

c.c. Mr. Edgar E. Maynard,
Road Maintenance Engineer.

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Fitchburg Wood Chippers are engineered to stand hard use, to give long service without excessive maintenance costs. There is only one Wood Chipper on the market today with a One Year Guarantee...The Fitchburg Wood Chipper.

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rector, Department of Public Works, Hartford, Conn.; Walter Bonnet, Engineer-Civil, U. S. Corps of Engineers, Washington, D. C.; Stanley I. Pinel, Consultant, Washington, D. C.; Dale N. Garst, Sanitation Director, Department of Public Works, Wichita, Kansas, and Leo Weaver, Secretary, Director of Research, American Public Works Association, Chicago, Ill.

Non-members of APWA may purchase *Refuse Collection Practice* from the Publisher, Public Administration Service, 1313 East 60th St., Chicago 37, Ill., price $8.00 per copy. The usual PAS discounts for quantity purchases apply. Distribution of the book to members of APWA will be handled by the APWA headquarters office. The American Public Works Association has made a bulk purchase of the books and is therefore able to offer its members this publication at a 25% discount. An additional 10% discount will be given if payment accompanies the order.

Three New Specifications Now Available From APWA

The headquarters office of APWA is pleased to announce the availability of three new specifications. The first is APWA Specification G —Bituminous Pavements (1958). This specification was prepared by a Committee chairmanned by Wallace W. Sanders, Director of Public Works and Chief Engineer of Louisville, Ky., and also included the following members: Thomas H. Coghill, Bexar County Road Engineer, San Antonio, Tex.; J. J. Sullivan, Supt. of Streets and Engineering, Springfield, Mass.; J. M. Tippee, Director of Public Works, Des Moines, Iowa; Julius Adler, Consulting Engineer, Philadelphia, Pa.; C. A. Keeping, Engineer of Streets, Winnipeg, Man., Canada; John Lambie, Los Angeles County Engineer, Los Angeles, Calif.; M. Osgood, President, Ann Arbor Construction Co., Ann Arbor, Mich.; and Paul Jorgensen, City Engineer, St. Petersburg, Fla.

Two basic types of construction are covered by this specification: Hot-mixed; hot-laid asphaltic concrete; and bituminous macadam surfacing. Provisions are also included to enable the user to modify the asphaltic concrete specification to cover sheet asphalt paving construction. This particular specification was originally prepared in 1936 and last revised in 1946.

Two additional specifications, prepared by the Association's Committee on Soil Stabilization, are also ready for distribution. One is APWA Specification K — Calcium Chloride Stabilization of Roads and Streets (1958) and the other is APWA Specification L—Lime Stabilization of Roads and Streets (1958). Harold F. Clemmer, Engineer of Materials and Standards for the District of Columbia, is Chairman of the Committee that prepared these specifications. Other members of the Committee are: William D. Monroe, City Engineer, Jackson, Mich.; Vernon C. Peebles, Chief Engineer of Raleigh, N. C.; Carl C. Fagerlind, Commissioner of Streets, Waterloo, Iowa; E. H. Lindstrom, Assistant City Engineer, Seattle, Wash.; Carl A. Distelhorst, Engineer - in - charge, Street Construction, Dept. of Public Works, Milwaukee, Wis.; and Reuben S. Rountree, Director of Public Works, Austin, Texas.

Minnesota, New Orleans and Georgia Chapters Elect New Officers

New slates of officers were recently elected at meetings of the Minnesota, New Orleans and Georgia Chapters. The annual meeting of the Minnesota Chapter was held in Minneapo-

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DUMPING RAW SEWAGE IN THE STREET

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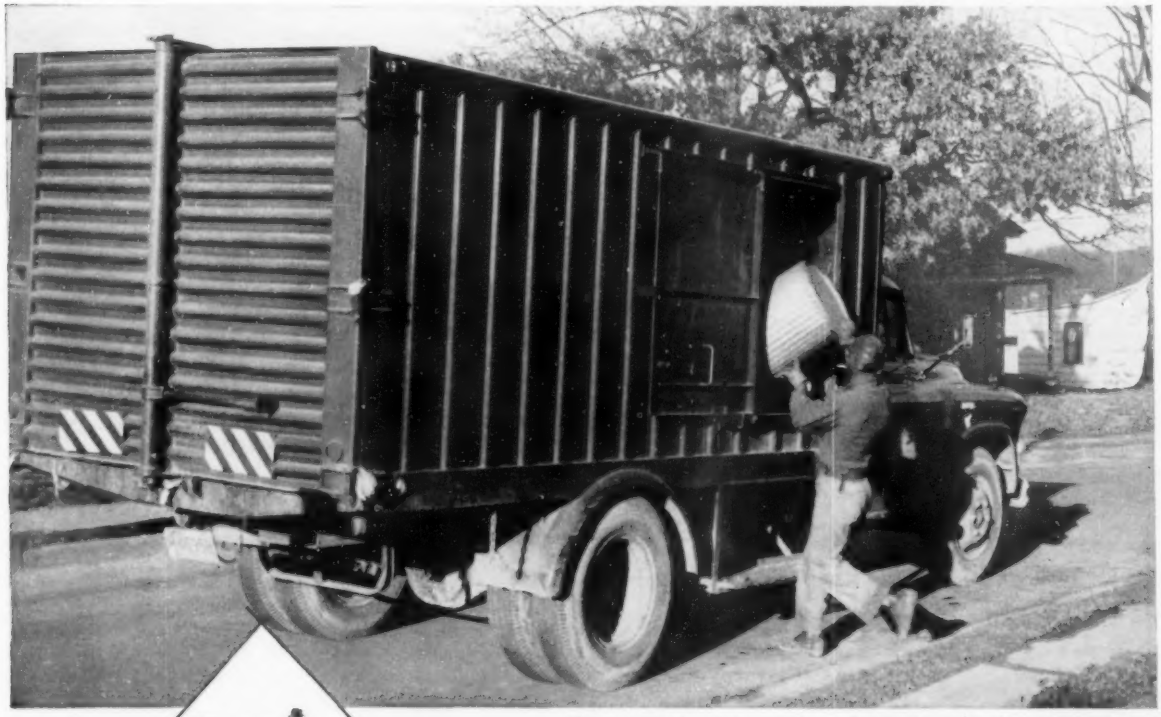
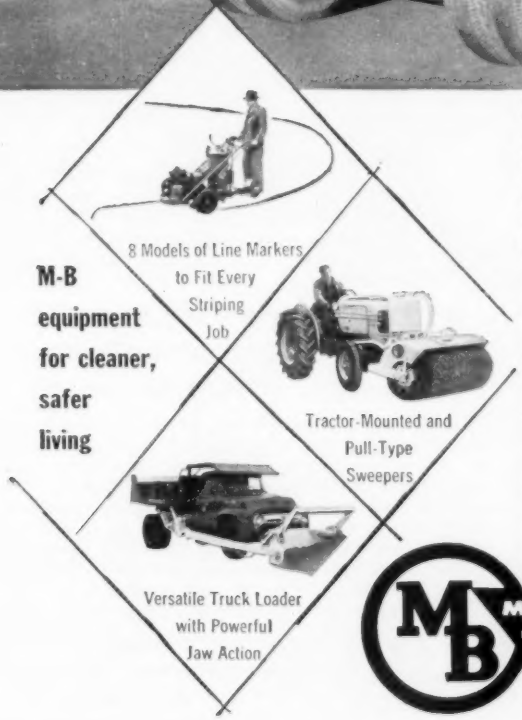
M-B packer improves service ...cuts route time

When the hustling City of Thomasville, North Carolina put a versatile M-B Packer Body to work for the collection of residential and commercial refuse, there was an immediate improvement in service with daily route time cut to only three hours. "Best of all," says Mr. J. F. Mitchell, Superintendent of Streets and Sanitation, "Our M-B Packer saves us $50 a week over the previous method of refuse collection. It is easier and faster to load and will haul any size object. Because of the M-B Packer's design, we get a full-capacity load on a smaller truck than is necessary for other types of bodies." ▪ Yes, easy does it with an M-B



Packer Body. Here's the only modern, sanitary refuse and garbage packer available that has *proved* in actual service to be the unit that provides more benefits from every dollar invested. It's *lowest in original cost*, outstandingly *lower in maintenance cost* and may be mounted on small, *lower cost trucks*. ▪ Together with unbeatable economy like this, you get a powerful packer that handles any type of load . . . garbage, refuse and trash. You get fast loading; powerful, progressive compaction; and safe, quick, "push-out" rear end unloading without raising the body . . . plus many other exclusive features. ▪ Investigate the M-B Packer *now* . . . compare advantages, compare payload capacities, compare economy . . . then ask your distributor for an on-the-route demonstration for final proof. Call him today!

M-B Corporation, New Holstein, Wis.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lis on June 11 thru 13 in conjunction with the Minnesota League of Municipalities convention. The meeting was opened with an address by APWA Regional Director E. J. Booth, City Engineer of Bismarck, N. D. A 10-year Public Agency membership certificate was presented to the City of St. Paul by Chapter President Ted Olsson. APWA Past President Milton Rosen, who is now serving as Commissioner of Public Utilities, accepted the award on behalf of the City.

Ervin Hensch, City Engineer of Duluth, was elected President of the Chapter. The Vice-President's post went to Graydon R. Boeck, City Engineer, Robbinsdale, and Frank Laska, Village Engineer of Bloomington was elected Secretary-Treasurer. Other members of the Chapter's Executive Committee include Stan Kelley, Supt. of Public Works of Bloomington, and Past President Ted Olsson, City Engineer of Faribault.

Over seventy members and guests attended the annual meeting of the New Orleans Chapter of the APWA which featured the installation of officers for the 1958-59 year. George F. Stevenson, Asst. District Engineer of the Louisiana State Highway Department was elected President of the Chapter to succeed Clarence Palm, Senior Gas Engineer of New Orleans Public Service, Inc. Elected to the posts of Vice President and Secretary-Treasurer were Stuart H. Brehm, Jr., Administrative Aide for the City Planning Commission, and Consulting Engineer Owen V. LeBlanc. John Porte, Asst. Engineer of the New Orleans Sewerage and Water Board, and Paul Ristroph, Director of the City's Department of Utilities, were also named to the Executive Committee.

The annual meeting of the Georgia Chapter, which was recently held in Savannah was highlighted by the election of R. N. Allred, Supt. of Motor Transport of Columbus as the Chapter's new President. He succeeds Grady Young, Sanitary Inspector for the City of Atlanta who will remain in the Executive Committee as Past President. Other officers elected were: E. F. Ledford, City Engineer, Valdosta, Vice-President; L. N. Hall, Supt. of Sanitary and Street Cleaning Department, Albany, Secretary-Treasurer, and Wyatt L. Wilson, Director, Dept. of Public Improvements, Savannah; Stafford Graydon, Sanitary Engineer, Atlanta, and "Prep" Phillips, Director of Public Works of Augusta, who were elected to serve the Chapter's Executive Committee.

FAIRCHILD ALUMINUM BRIDGE FEATURES SHOP-ASSEMBLED COMPONENTS

A NEW TYPE aluminum bridge, which employs aircraft design principles and is more economical than conventional spans of other materials, was shown to engineers, road builders and federal and state highway officials at Lehigh University, Bethlehem, Pennsylvania.

Co-sponsors of the test project are Fairchild Engine and Airplane Corp.; the Bureau of Public Roads (U. S. Department of Commerce); Aluminum Co. of America; Kaiser Aluminum and Chemical Sales, Inc.; Metals Division, Olin Mathieson Chemical Corp.; and Reynolds Metals Co. Prof. William J. Eney supervised the test sequence.

Basic fabrication of the test bridge is of thin-gauge stressed sheet

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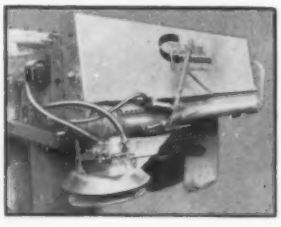

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The economic Arps Model M Trench-Devil will handle most of your trenching jobs faster, easier and at lowest cost per foot of trench. For the largest percentage of ditching work — foundations, water services, underground wiring, gas lines, sprinkler systems — this heavy duty, one-man outfit will outdig larger units costing many times its low price. Get more information *now* on this and other famous Arps Trenchers for larger and smaller jobs. The Arps Corporation, New Holstein, Wis. Dept. PW

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TRENCHERS

HALF-TRACKS • BULLDOZERS

UTILITY BLADES

Harrisburg, Pa., joins the list of communities that use the C-E Raymond System for sewage sludge disposal

The new $7.4-million primary sewage treatment project at Harrisburg, designed by Gannett Fleming Corddry and Carpenter, Inc., and being financed and constructed by The Harrisburg Sewerage Authority, will serve an equivalent population of 175,000. It will have an average influent capacity of 27 mgd, and a peak capacity of 60 mgd.

The C-E Raymond Flash Drying and Incineration System here will reduce filter cake to a uniform product, having a total moisture content of only 10 per cent. Included in this system will be C-E's high temperature Deodorizing Preheater to remove annoying odors, and a centrifugal collector to eliminate fly ash. The dried product will be bagged for use as soil conditioner and sold locally. In addition, it can be used on the city's lawns, parks and golf courses. Surplus sludge can be *completely* burned in the C-E Raymond System incinerator, resulting in a clinker-free sterile ash.

It is for good reason that communities throughout the country are choosing C-E Raymond – the only system that permits flash drying and incinerating, separately or together, in any proportion. Contact your nearest C-E office to learn how this system can aid your community. We will be happy to discuss your needs with you or your consultants. No obligation, of course.

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C-170

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For further details on the C-E Raymond System—and data on more than 40 installations—mail this coupon to Combustion Engineering, Raymond Division, 200 Madison Avenue, New York 16, N.Y.

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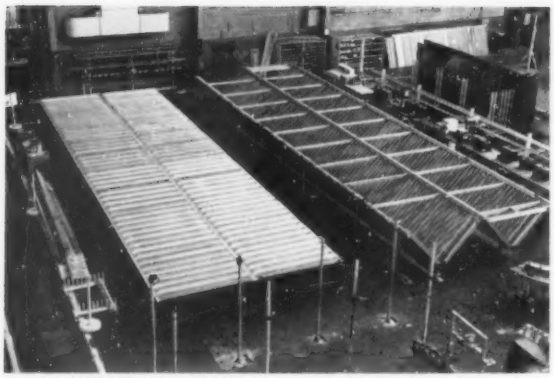
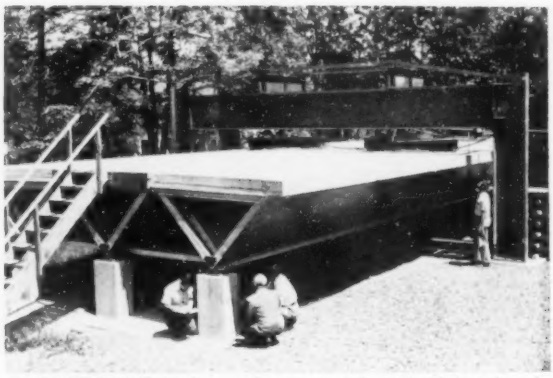


● **LOW-COST mass-production methods can be employed for fabrication and assembly of the Fairchild Aluminum Bridge.**



● **PROTOTYPE bridge under test at Lehigh University. In this test, pulsating jacks simulated 100 years of service.**

aluminum. It is 24 feet wide and 50 feet long, supporting a two-lane conventional concrete roadway with a design vehicular load limit of 15 tons per lane. During the demonstration, loads far in excess of the design limit were placed on the span.

There were 130 different instruments installed to record behavior of the prototype bridge under both static and dynamic load conditions. Special pulsating jacks are being used to shake the structure for more than one million cycles. This is equal to more than 100 years of normal use. Test loads of up to 52 tons, or 175 percent of the design vehicular load limit, were placed on the bridge without any indication of failure or excess fatigue.

Economical Production

The Fairchild bridge lends itself to in-plant production of sections that can be easily transported by truck, rail or air. It is easily assembled in the field. The test bridge itself, for example, was erected by four men and a crane operator in less than two days. Main advantages are initial low cost and freedom from protective maintenance.

Development of the bridge design was begun by Fairchild more than a year ago. The project was coordinated from its earliest stages with officials of the Bureau of Public Roads, principally, E. L. Erickson, chief of the Bridge Design Division; H. A. Radzikowski, chief of the Development Division; George S. Vincent, Office of Research; and Neil Van Eenam, Bridge Engineer.

Actual design of the bridge was accomplished at the Fairchild Kinetics Division in New York, under the direct supervision of A. A. Gassner, Division General Manager.

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Patterns on hand for over 15,000 different Gray Iron and Ductile Iron construction castings.
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EFFICIENCY PLUS!

Combine the new LOAD-PACKER 500 with new all-hydraulic container system

Now, Gar Wood's Load-Packer 500—the world's most efficient refuse collection unit—can provide modern "containerized" service for better sanitation . . . at lowest cost.

Featuring a revolutionary 10-second loading cycle . . . 1½-cubic yard hopper . . . full 75" loading width . . and massive 81,000-lb. compaction force, the Load-Packer 500 in competitive tests packs up to 25% more refuse.

With the new all-hydraulic Pax-All Container System, the Load-Packer 500 can now be used for multi-stop container service . . . yet, there's no interference with regular crew-loaded operations.

Learn all about the Load-Packer 500 and Pax-All Container System. Contact your nearest Gar Wood-St. Paul truck equipment distributor, or write to: Customer Service Department, Gar Wood Industries, Wayne, Michigan.

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PUBLIC WORKS DIGESTS

Prepared by

ALVIN R. JACOBSON, Ph.D.
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE SEWERAGE AND REFUSE DIGEST

Turnpike Service Areas

In 1954, when the design and construction of Service Area Facilities for the Northern Indiana East-West Turnpike was being considered, very little basic design and operating data was available on this type of facilities. Only the Pennsylvania and New Jersey Turnpikes had been completed and were in operation. Their operating experiences were drawn on heavily for the design. Their experiences showed that the combined kitchen and sanitary waste averages 500 to 550 mg/L BOD; 150 to 200 mg/L suspended solids; 75 to 100 mg/L grease; and approximately 100 mg/L active ingredients. An average flow of liquid waste of 150 gallons per day per dining room chair and 350 gallons per day per counter chair may be anticipated. A treatment process was desired which would very nearly run itself, except for good housekeeping measures and care of equipment. The final design for the sewage treatment plant consisted of the high rate trickling filter process, employing a constant recirculation flow rate, regardless of the raw sewage flow. The final design consisted of the following units: Comminutor, lift station, separate sludge digestion, primary, intermediate, and final sedimentation tanks, two-stage high rate filters and recirculation pumps. Facilities for pre-digestion were provided for use in the event pre-digestion proved advantageous as an operating procedure. These facilities have not been used as results have been satisfactory under standard operating procedures.

"Turnpike Service Areas." By W. F. Middleton. *Water and Sewage Works*, August, 1958.

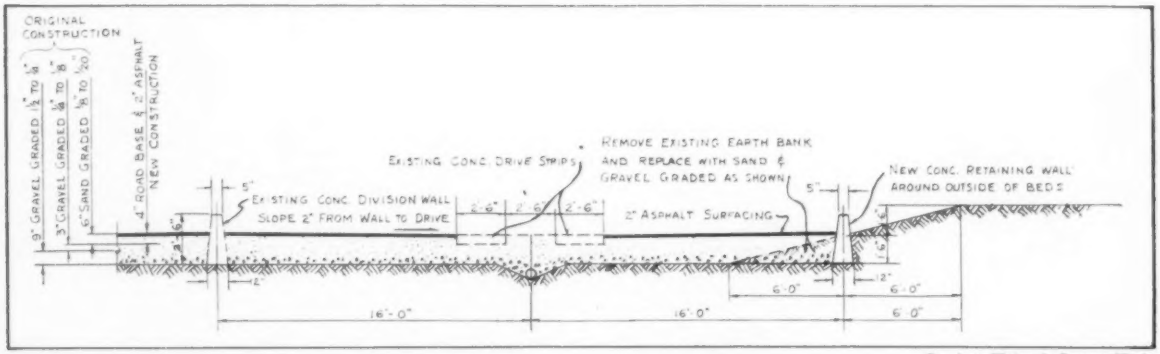
Totally Enclosed Plant

In August, 1955, Groton, Conn., placed in operation treatment works which were the culmination of a 10-year search for a suitable location for a sewage treatment plant. The selected site required the construction of a bulkhead on the Thames River, with fill placed behind it to create sufficient area for the plant and its future extension. In addition, it was located in the midst of a residential area. In view of the size and character of the receiving water the construction of a primary treatment plant was approved by the state authorities. The design flow of 1.0 mgd was based on a population of 10,000. By providing an additional comminutor and settling tanks, the plant capacity can be increased to 2.0 mgd. The primary sewage treatment plant also provides for separate sludge digestion and separate sludge dewatering, together with effluent chlorination. In addition, chlorination equipment is provided for applying chlorine gas automatically or manually to the raw sewage for disinfection and odor control. Due to the close proximity of residences, the nearest being about 120 ft. from the plant, it was imperative that no nuisance be caused by the plant. Accordingly, no sewage is exposed in any area.

"Reclaimed River Edge Site Used for Totally Enclosed Plant." By Dean F. Coburn. *Wastes Engineering*, August, 1958.

Cesspool Sludge Digester

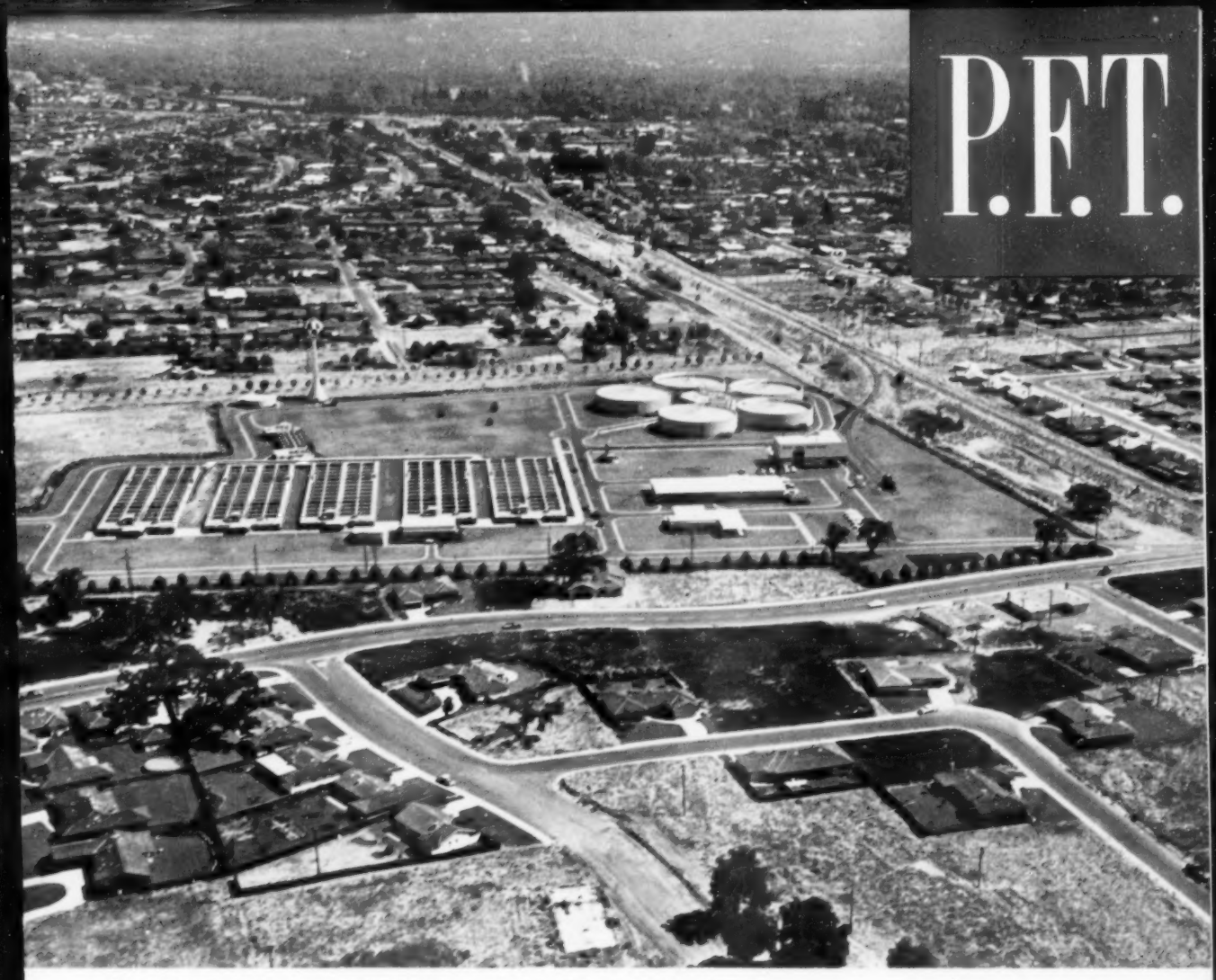
The Town of Babylon, N.Y., has solved the age-old problem of disposing of sludge from individual cesspools used by the homes in this unsewered area of Long Island. It involves the use of modern, controlled sludge settling and digestion facilities for the solids collected by private cesspool and septic tank cleaners, and delivered to the township sewage disposal plant. This unusual process was located adjacent to the community's refuse incinerator and thermally interlocked with it by means of hot water coils in the furnace combustion chamber which maintain optimum temperature in the sludge digesters. Three receiving manholes were installed to serve three tank wagons simultaneously. Three concrete tanks were installed, one of which provides settlement and concentration of the tankage. The concentrated sludge is intermittently withdrawn to the sludge digestion tank which is equipped with a fixed intermediate cover with


ORIGINAL CONSTRUCTION
9" GRAVEL GRADED
3" GRAVEL GRADED
6" SAND GRADED
4" ROAD BASE & 2" ASPHALT NEW CONSTRUCTION
EXISTING CONC. DRIVE STRIPS
REMOVE EXISTING EARTH BANK AND REPLACE WITH SAND & GRAVEL GRADED AS SHOWN
NEW CONC. RETAINING WALL AROUND OUTSIDE OF BEDS
EXISTING CONC. DIVISION WALL
SLOPE 2" FROM WALL TO DRIVE
2" ASPHALT SURFACING
16'-0"
16'-0"
6'-0"

Courtesy Water & Sewage Works

● **SLUDGE drying bed is paved with asphalt. Salt Lake City, Utah, installation utilizes new principle, which is said to result in faster drying time and lower maintenance and operating costs, is described in an article by William T. South.**

P.F.T.



Sacramento's modern sewage treatment plant is now surrounded by fine homes.

Good Neighbors in Sacramento

Exclusive new residential development selects modern sewage treatment plant as good neighbor

Sacramento proves a point! Gone are the days when the sewage treatment plant was the unsightly skeleton in every city's closet—to be hidden "out on the old river road." In fact, in Sacramento, California, this modern sewage treatment plant has been *selected* as a good neighbor by an exclusive new residential development. As you can see, these expensive homes are being built adjacent to the beautiful treatment plant.

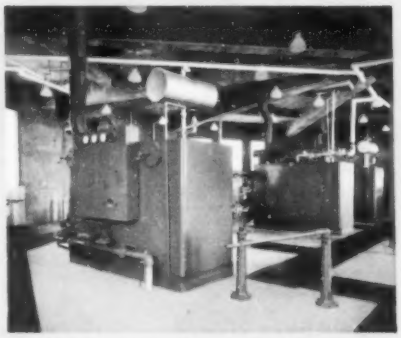
Modern sewage treatment equipment makes this all possible. Odor problems have been eliminated.

Attractive architecture and landscaping make this plant a well accepted part of the new residential area of this thriving city of Sacramento.

Sacramento is one of the many progressive cities across the country that has found that modern sewage treatment equipment—P.F.T. Equipment—and a modern sewage treatment plant are truly a civic asset. For further information on the Sacramento Story please turn this page.

P.F.T. *contributes to the Sacramento Story*

Only the most modern sewage treatment methods and equipment enables Sacramento to prove that a sewage treatment plant can now be an integral part of *any* growing community. P.F.T. equipment plays a vital part in this progressive sewage treatment program. This P.F.T. equipment includes five 100′ Floating Covers, five Cover Position Gauge Boards with Low Level Alarms, three #1000 Gas Fired Heaters and Heat Exchangers, Gas Safety Equipment.



Three PFT #1000 Heaters and Heat Exchangers make Sacramento's digestion system efficient and dependable.

Here are Sacramento's five digesters equipped with five 100′ P.F.T. Floating Covers.

Design of plant by:
Engineering Office of Clyde C. Kennedy, San Francisco.

P.F.T.

waste treatment equipment exclusively since 1893

PACIFIC FLUSH TANK CO.

4241 Ravenswood Avenue
Chicago 13, Illinois

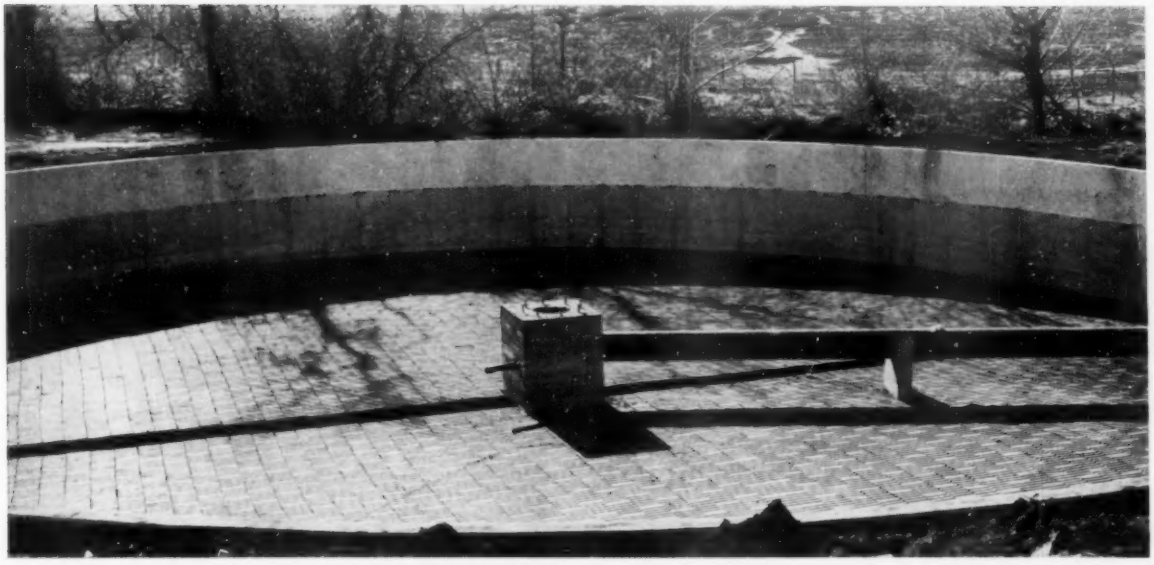
PORT CHESTER, N. Y. • SAN MATEO, CALIF. • CHARLOTTE, N. C. • JACKSONVILLE • DENVER

SPECIFY VITRIFIED CLAY BLOCKS

in your trickling filter underdrains—and be sure!

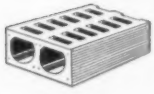
Tearing up a filter bottom a few years later to replace failed blocks made of substitute materials is no fun. Neither is it necessary. Get them right the first time by specifying vitrified clay underdrain blocks.

ASTM Specifications C 159-55, with TFFI members' 50-year guarantee of their vitrified clay blocks, are your assurance of permanence and satisfaction. Made in modern plants under modern manufacturing controls usually impossible with blocks made of substitute materials, vitrified clay affords permanent protection against acids, alkalis, and bacterial actions.



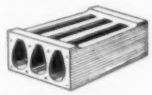
Trickling Filters' Great Advantages

Include low initial cost, low operating costs, flexibility and adaptability, simple easy operation, long life—longer than that of bonds issued to pay for them, top-notch effluent, and overloading no problem.

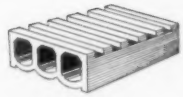


ARMCRE
Ayer-McCarel Clay Co., Inc.
Brazil, Ind.

DICKEY
W. S. Dickey Clay Mfg. Co.
Kansas City 6, Mo.



NATCO
Natco Corporation
337 Fifth Ave.
Pittsburgh 22, Pa.

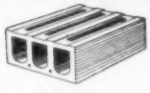


TRANSLOT
Texas Vitrified Pipe Co.
Mineral Wells, Texas

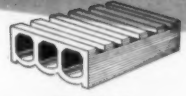
TFFI

Symbol of good treatment

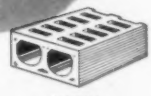
TRICKLING FILTER FLOOR INSTITUTE



POMONA
Pomona Terra-Cotta Co.
Greensboro, No. Car.



TRANSLOT
Cannelton Sewer Pipe Co.
Cannelton, Ind.



BOSCO
Bowerston Shale Co.
Bowerston, Ohio

ADDRESS ANY MEMBER OF THE INSTITUTION FOR FULL DETAILS AND SUGGESTED SPECIFICATIONS FOR BLOCKS

mezzanine compartment above for supernatant liquor. This liquor rises vertically through an 8-inch pipe to the upper compartment where it may be heated by means of copper hot water coils. The fixed roof between the lower and upper compartments of the primary digestion tank provides for the storage of sludge gas underneath it. The accumulating gas displaces liquor from the digestion compartment of the tank to the upper compartment, where it overflows to the secondary digestion tank. The concentrated digested sludge is withdrawn to open sand beds for drying. The installation cost of this project was $76,000 and the operation of the plant has proven to be very successful.

"Modern Digestion Facilities for 'Old Fashioned' Cesspool Sludges." By Henry W. Taylor. *Wastes Engineering*, August, 1958.

Sanitary Landfill Operation

Proper operation of a sanitary landfill begins with the selection of a site. The factors to be considered are 1) distance of haulage; 2) area needed; 3) neighborhood, i.e., nearness to residential areas; 4) costs for land, access roads, drainage, fencing, etc.; 5) topography; 6) control of private dumping; and 7) cover material. When sanitary landfills are constructed in accordance with good operating procedures, using equipment of a type and size suited to local conditions and the work to be performed, they have proved to be an economical and effective means for refuse disposal. In addition, they offer a way to develop land which might otherwise be useless and a detriment to the community. However, like every other municipal project, sanitary landfills must be properly planned, well operated and conscientiously supervised if maximum benefits are to be obtained.

"Operation of Sanitary Landfills." PUBLIC WORKS, September, 1958.

Virus Concentration Follows MPN Results

For the purpose of evaluating currently used bacteriological criteria for estimating the presence of virus in sewage, parallel tests were made of the MPN of coliform and enterococci and of the presence of enteric viruses. A total of 1,403 tests were made over a period of 24 months on the sewage of two cities: an industrial one, Lansing Mich., and one that is primarily residential, East Lansing. Using suckling mice and monkey kidney tissue cultures, viruses were isolated 8 percent of the time and included the Types I and III polio, Coxsackie and the ECHO viruses. Dip, pad and sludge samples were collected with viruses isolated 30 times from Lansing and 88 times from East Lansing sewage. The coliform and enterococci MPN values over a 12-month period followed the same general pattern as the concentration of the viruses. Tests on the non-chlorinated final effluent from the East Lansing sewage treatment plant showed that some virus was not removed by treatment, and the highest concentration was found in the raw sludge. Studies with *Salmonellae* will be reported later.

"Isolation of Enteric Viruses and *Salmonellae* from Sewage. I. Comparison of Coliform and Enterococci Incidence to the Isolation of Viruses." By W. N. Mack, W. L. Mallman, H. H. Bloom, and B. J. Krueger. *Sewage and Industrial Wastes*, August, 1958.

Municipal Incinerator Trends

A modern municipal incinerator bears little resemblance to its predecessor of a quarter century ago. An example is one completed last year for the industrial city of Bing-

FOUR BIG REASONS for Specifying

IMCO

Floor System for All Types of Trickling Filters:

1—It simplifies construction— The units are self-spacing; they are easily set; they have high strength, thus permitting mechanical placing of filter stone . . .

2—It assures effective aeration—The grill blocks afford maximum apertures, with 40% of the filter area open to ventilation . . .

3—It provides excellent drainage— The channel blocks are smooth and unobstructed and flush jointed . . .

4—It gives flexibility of design— Filter blocks are supplied in shapes and fractional sizes to fit all forms of filters without the necessity of cutting blocks . . .

Our Engineering Department will gladly cooperate with Engineers in solving the design problems of all standard and high-rate trickling filters.

INDUSTRIAL MATERIALS CO.
Somerset St. and Trenton Ave.
Philadelphia 34, Pennsylvania

BULK MATERIAL MEN:

AUTOMATE

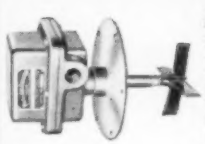
PRESENT EQUIPMENT FOR

BULK MATERIALS

HANDLING WITH

ROTO-BIN-DICATOR®

LOWEST COST MODERNIZATION



If you store, process or pack bulk material you can have automatic control of handling at nominal cost with a few Roto-Bin-Dicator bin level indicator units. Prevent waste, protect equipment, save repairs. Big savings year after year. U. L. Listed Standard and Explosion-Proof Units.

THE BIN-DICATOR CO.
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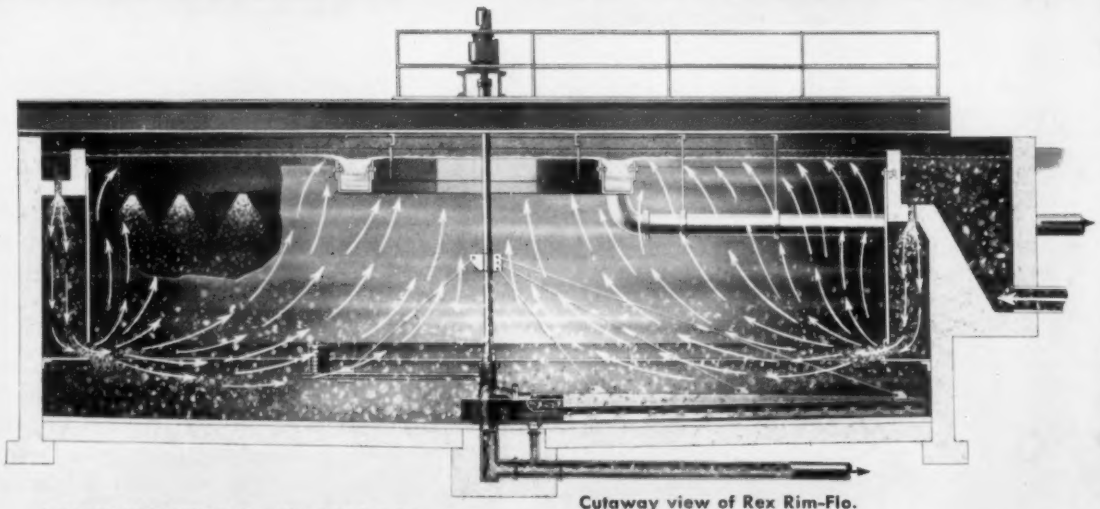
Write for detailed literature or call VAlley 2-6952

WE SELL DIRECT • PHONE ORDERS COLLECT

The new REX® Rim-Flo Clarifier

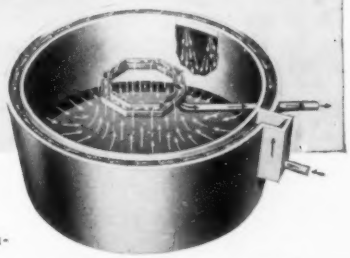


Cutaway view of Rex Rim-Flo.

A NEW HYDRAULIC PRINCIPLE FOR...

- Maximum Hydraulic Efficiency
- Maximum Use of Tank Volume
- Optimum Settling Conditions
- Greatly Increased Capacity
- Simple Scum Removal

IN CIRCULAR TANKS



Simplified cutaway view of Rex Rim-Flo illustrating flow patterns.

The Rex Rim-Flo Clarifier brings a new high in efficiency...a new high in performance to circular settling tanks.

The unique, thoroughly proven hydraulic principle of the Rim-Flo introduces the influent into a circular feed channel entirely around the periphery of the tank. The channel is of uniform width but the depth gradually decreases from the deepest point at the influent point to the shallowest at the extreme end of the circle. A series of properly sized ports are correctly spaced in the floor of the feed channel. This combination of tapered-channel cross section and spaced ports assures a uniform forward-flow velocity in the channel, even though the volume decreases as each port takes its share of the flow. This controlled flow velocity prevents any settling out of solids in the channel and assures transportation of all scum to the end of the channel for collection.

The ports direct the flow downward into the tank between the tank wall and a vertical skirt. The flow approaching the tank bottom is at an extremely low velocity and is directed into the main body of the tank. Solids promptly drop out of suspension onto the tank floor. The flow is directed gently upwards to a central effluent trough.

Rex Rim-Flo is the practical economical solution to the problem of outmoded or overloaded circular settling tanks. Rim-Flo can be adapted to existing circular tanks of practically any size.

For additional information on Rex Rim-Flo or any of the other *plus value* Rex Equipment, write CHAIN Belt Company, 4722 W. Greenfield Ave., Milwaukee 1, Wisconsin.

CHAIN BELT

hamton, N.Y. The three-story brick and concrete incinerator building is located on a 75-acre site behind the east bank dike of the Chenango River, within ¾ mile of the central business district. Minimum collection costs will be assured because of this central location, and the low adjacent areas will receive the incinerator residue for many years and will ultimately be developed into a recreational area. The incoming trucks are weighed and the refuse is dumped into a 200-ton bin. A traveling bridge crane with bucket transfers the refuse from the storage bin to the two incinerator units of 300 tons combined capacity. Each incinerator has a forced draft fan for undergrate combustion air. Residue is removed by dropping it into a conical shaped hopper where it is quenched with water, and then dropped into a truck. Gases leave the ignition chamber by means of an overpass flue and enter a two-story circular combustion chamber, where the temperature is maintained at about 1800° F. A settling chamber 47.75 ft. long by 22 ft. wide and 12.0. ft. high was designed to maintain a chimney effluent with minimum fly ash content. The chimney has an internal diameter of 10 feet and a height of 145 feet from grade. This modern plant is operated 12 hours per day by a crew consisting of one crane operator, one charging floor man, two operating floor men, and one ash floor man. In addition, there is a weighmaster, plus supervisory and janitorial personnel and relief men.

"Municipal Incinerator Trends." By R. F. Sternitzke. PUBLIC WORKS, September, 1958.

Other Articles

"Algae and Their Effects on D.O. and B.O.D." Part III of a series of articles on this important phase of stream pollution in which Dr. Bartsch discusses the Wisconsin studies of T. F. Wisniewski in light of the experimental studies at the Robert A. Taft Sanitary Engineering Center. By A. F. Bartsch. Water and Sewage Works, August, 1958.

"A Check List for Sewage Treatment Plant Design." By George R. Elmore and Joseph C. Yarbrough. Public Works, September, 1958.

"Small Sewage Treatment Plants: Trickling Filters." A detailed discussion of trickling filters for small sewage treatment works to provide biological treatment where primary treatment is not adequate. By John J. Baffa. Public Works, September, 1958.

"Waste Stabilization Ponds III. Formulation of Design Equations." By E. R. Hermann and E. G. Gloyna. The procedure involved in derivation of a formula for design is described. Factors considered are volume, population, per capita flow, BOD and temperature. Sewage and Industrial Wastes, August, 1958.

"Uniform State and Interstate Sewage Treatment **Design Standards**—A Panel Discussion." An annual meeting panel composed of George W. Martin, Leader, John W. Townsend, Frank H. Miller, and Earl Devendorf reviews the standards in force in the various states and the feasibility of making them uniform. Consultant's, operator's, and regulatory agency's viewpoints are presented. Sewage and Industrial Wastes, August, 1958.

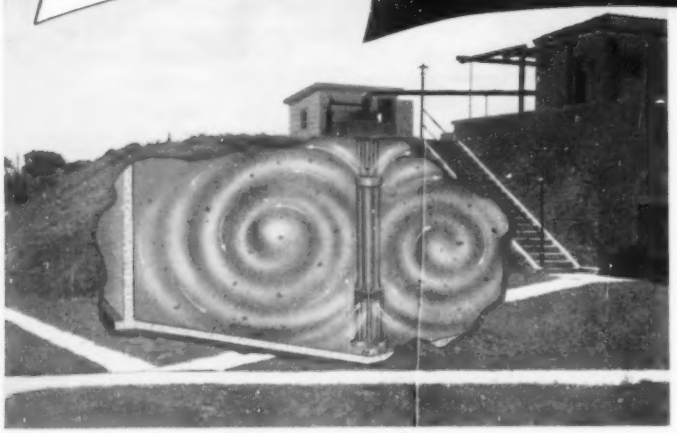
• • •

Sludge Filter to Alleviate Emergency Situation

A 200-sq. ft. Komline-Sanderson Coilfilter is being manufactured and shipped (within 45 days of the receipt of the order) to alleviate an emergency situation that has arisen at East Lansing, Mich. Overloaded digesters at the sewage treatment plant have created an odor nuisance, causing complaints from the nearby dormitories and apartments on the campus of Michigan State University. It is planned to dewater fresh sludge in order to ease the overload on the digesters.

the process... DIGESTER CIRCULATING-MIXING

the equipment... WALKER PROCESS GASLIFTER GASLIFTER UNIT



Above—Installation at Aurora Sanitary District, Aurora, Illinois serves to illustrate circulation and mixing action achieved with GASLIFTER. Published operating data attests to the resulting increased efficiency.
Walter A. Sperry.....Supt., Aurora Sanitary District
Walter E. Deuchler Co., Aurora.....Consulting Engineers

DIGESTER CIRCULATOR MIXER

INCREASED CAPACITY—GASLIFTER circulated digesters easily handle loadings of 6 lbs. of solids/cu. ft./mo.

BETTER DIGESTION— 15 to 20% more gas (methane) per lb. of volatile solids, together with low and uniform volatile acids—all accomplished in single stage digestion at high loading rates.

ELIMINATES SCUM BLANKETS AND GRIT SHOALS—Rapid circulation along roof, walls and bottom disperses grease blanket and prevents loss of capacity due to grit shoaling.

ADAPTABLE TO STANDARD OR HIGH RATE DIGESTION—The GASLIFTER may be applied to either standard or high rate digesters with equally efficient results.

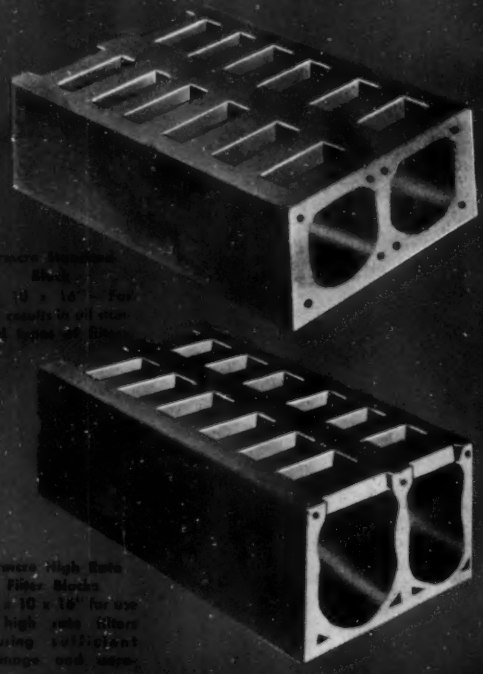
ACCESSIBLE—specially designed locking chamber permits individual inspection and service of stainless GASLIFTER sparging units without dangerous gas loss or digester shutdown.

NO MECHANICAL SHUTDOWNS—GASLIFTER utilizes gas-lift principle and completely avoids mechanical troubles from rag and sewage "string" fouling. Sparjers used to diffuse gas in the eductor tube avoid all orifice troubles.

GASLIFTERS incorporate the patent rights of Joseph Cunetta
GASLIFTER is a trademark of Walker Process Equipment Inc.

WALKER PROCESS

WALKER PROCESS EQUIPMENT, INC.
FACTORY • ENGINEERING OFFICES
LABORATORIES
AURORA, ILLINOIS

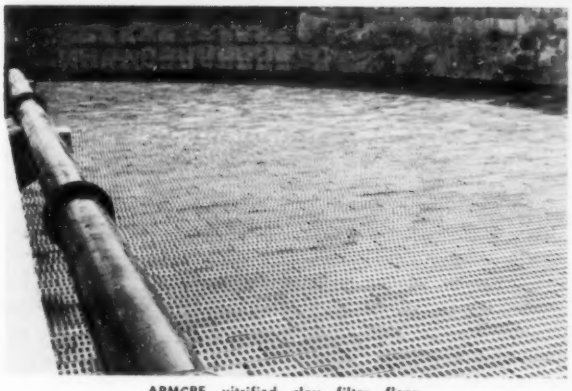


specify

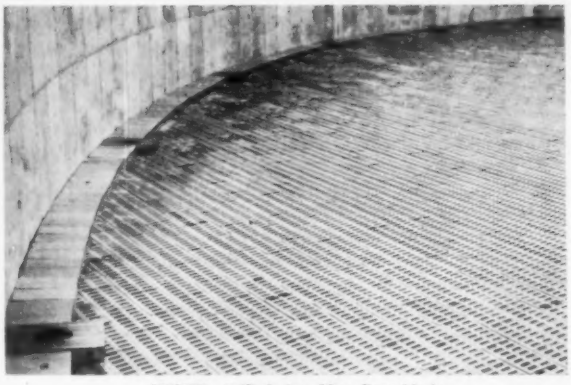
ARMCRE BLOCKS

for trickling filter floors and walls

At a lower cost per year than any substitute can ever offer



ARMCRE vitrified clay filter floor blocks in Geneseo, Ill., trickling filters



ARMCRE vitrified clay filter floor blocks in Lebanon, Ind., trickling filters

Essentials of a Good Filter Bottom

Ample openings quickly to drain the filter and to prevent deposits of humus and organic matter which retard the discharge of the filter and reduce its oxidizing power. **Ample channel capacity** to carry off the effluent quickly once it has been discharged from the rock. **Smooth channels** of Semi-Salt glazed vitrified fire clay that prevent the adhesion or absorption of solids. **Circular channels** that maintain good velocities with low flows that provide ample capacity for overload conditions. **Ventilating capacity** to assure an abundant supply of air to the filter under all conditions of service. **Durability and long life. Economy** in construction by the use of one-piece blocks that are simple and easy to lay. Contractors' cost records establish this fact.

Armcre Blocks Meet All of These Essentials

For further information see ASTM Designation C 159-48 T Specifications for Vitrified Clay Filter Block for Trickling Filters. ***Write for Estimating Costs.***

Armcre Wall Blocks For Trickling Filters
Save 20% on the average construction costs. **Save Steel** for reinforcing other types of construction—a more costly item now. **Improve Appearance.** No other material gives so attractive a filter wall. **Simple to Use.** Low construction cost. Exact alinement. Permanency is also an added feature of ARMCRE wall blocks.

AYER-McCAREL CLAY COMPANY, INC.
Brazil, Indiana
Facilities of Two Plants Insure Prompt Service

AN EPIDEMIC OF ENTERITIS BLAMED ON CROSS-CONNECTION

FLOYD M. MILLER
and
BEN FREEDMAN, M.D., M.P.H.

Abstracted from Public Health Reports

THE INCREASING use of water by household for its many appliances increases public health hazards related to the water supply. The creation of more cross-connections, backflow connections and open connections to accommodate these appliances and devices demands that sanitary engineers remain vigilant to prevent contamination of the water supply.

The misuse of one such device, an automatic lawn sprinkling system, led to contamination of the city water supply, resulting in an epidemic of enteritis in Shreveport, La. In the summer of 1947, Mr. X installed a pump in Bayou Pierre, which flows behind his property, to supply water to the sprinkling system for the rear lawn of his home. In 1953, he installed for his front lawn an underground sprinkler system which drew its water from the city supply. This sprinkler system having been laid out in conformity with Shreveport's plumbing code, he applied to the city for a tap and meter for the system.

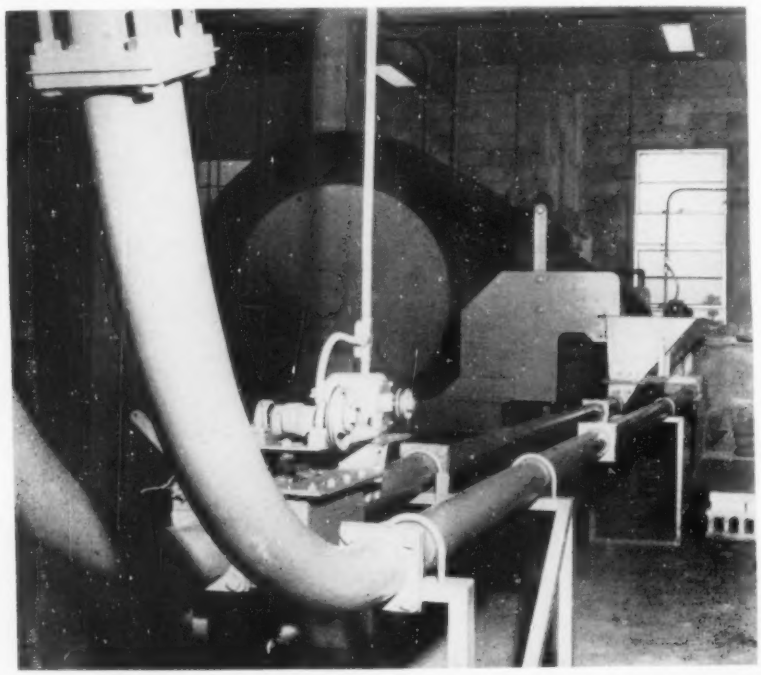
In June, 1954, he installed an automatic time clock system and a booster pump in his yard to use the bayou water for his whole sprinkler system. At the same time, he replaced the pump in the bayou with another of 10-hp capacity. He thought that the automatic timing system prevented a cross-connection. When the front sprinkler was connected to the bayou water system, the bayou water was not completely cut off from the city water main. Only a manually operated valve intervened between the city system and the bayou water system for the front lawn. The setup maintained a pressure in the sprinkler line of 65 pounds. Apparently, however, the pressure in the city water main at this point was at no time greater than 58 pounds.

Unfortunately, no inspection by the city plumbing inspector was requested. The yardman, not knowing the hazard, opened the valves from the city water supply to prime the booster pump and left them open. Thus, when the time clock set the system into operation every 24 hours, water from both the bayou and the city main was forced through the system at the same time. Water from the bayou was probably forced into the city main for a fairly long period, since the two gate valves were found in the open position.

On August 7, 1956, a broken sewer line about one-half mile from the pump, was reported to the health department. Investigation on August 8 revealed that the sewage from the broken line was draining into the bayou, and that the break had occurred about the beginning of August. Previously, the bayou water was fairly clear.

On August 8 the sewer break was corrected. The same day, the office of Shreveport's commissioner of public utilities received a call from a resident who said that the hydrant water in his house appeared green. An investigation was made, but the health department was not notified.

On August 11, a neighbor phoned the Health Department, stating that he, his wife, and his children were sick. He said there was a rumor



Above photo illustrates odor-tight Coral Gables installation handling vacuum filter cake direct to Flash Dryer in fertilizer production without exposure to air at any time. Very odor-free.

HAPMAN CONVEYORS WIN AGAIN!

No design is complete without them.

SELECTED AT:

Birmingham • Los Angeles
Coral Gables • Hollywood (Fla.)
Lackawanna • Indianapolis
Atlanta • Richmond, etc.

For Sewage Grit, Vacuum Filter Cake, Lime, Alum, Carbon

Write for complete list, photos.

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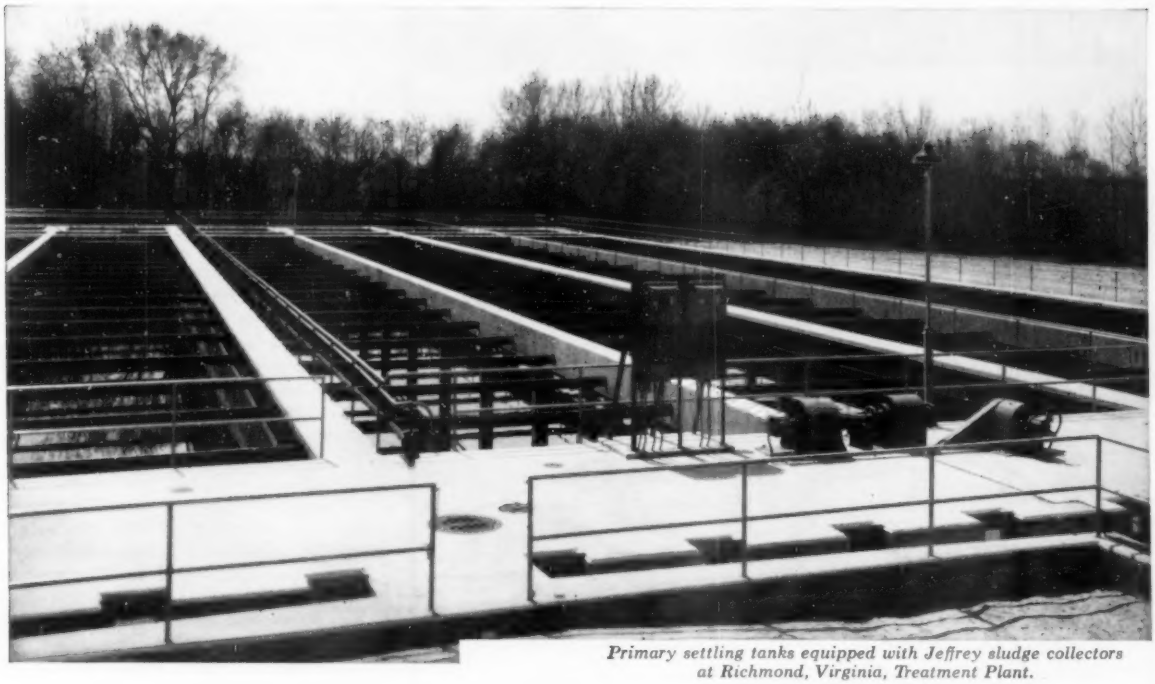
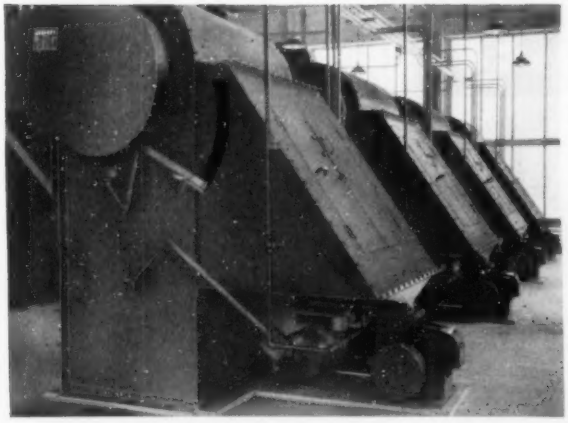
516 N. CHARLES ST., BALTIMORE 1, MD.



Primary settling tanks equipped with Jeffrey sludge collectors at Richmond, Virginia, Treatment Plant.

New waste treatment plant prepares Richmond for 2000 A.D.



Jeffrey mechanically cleaned bar screens with screenings grinders at Richmond plant. Grit is received from V-bucket type collectors, and washed by Jigrit washer.

Can a treatment plant, operating at optimum efficiency in 1958, be just as efficient in 2000 A.D.? The City of Richmond, Virginia, thinks it can:

Their new Jeffrey-equipped primary treatment plant satisfies current needs with a dry weather flow of 28 mgd. As designed by consultants, Greeley and Hansen, the plant may be easily converted to 126 mgd. secondary treatment, based on a population of 554,000 by the year 2000. Thus an intelligent, long-range plan provides Richmond with a system geared for today, yet fully adaptable to the more-than-double capacity needed for tomorrow.

Jeffrey's line of treatment plant equipment includes bar, disc and traveling water screens, grinders, collectors, washers, scum removers, feeders and FLOCTROL (controlled flocculation). Catalog 905 describes this and other equipment for water, sewage and industrial waste treatment. The Jeffrey Manufacturing Company, 947 North Fourth Street, Columbus 16, Ohio.

JEFFREY

CONVEYING • PROCESSING • MINING EQUIPMENT...TRANSMISSION MACHINERY...CONTRACT MANUFACTURING

WEMCO® the INCREDIBLE Torque-Flow Pump

pumps almost everything

(what will go in will come out)

secret: recessed impeller; continuous open passage

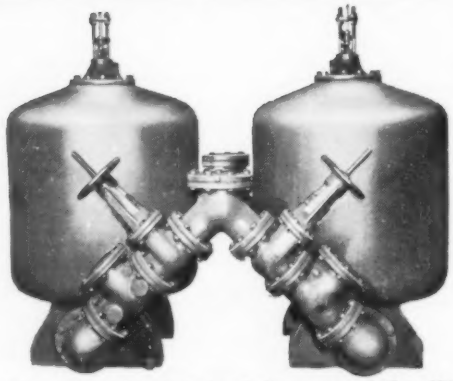
(maintenance a thing of the past)

Western Machinery Company 650 Fifth St. • San Francisco, Calif.

CUT OPERATING COST
SIMPLIFY LIFT SYSTEM

THE BLACKBURN-SMITH WAY . . .

Blackburn-Smith Pneumatic Sewage Ejectors give you better sewage lifting for less money. Simplest to operate. No complex piping, screens, impellers, shredders, pumps which need constant cleaning and costly maintenance. It will pay you to know the many exclusive features of design and operation of these time-tested units. Backed by 60 years' experience.



Duplex Ejector Twin Units for discharge rates of 30 to 500 g.p.m., heads up to 150 ft. Also made in single units.

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WRITE FOR CATALOG S-55

Shows application, advantages, dimensions and layouts of B-S Pneumatic Sewage Ejectors, single and duplex units. Describes exclusive features of float, electric and pneumatic controls. Tells how to select proper size ejector.

that the water was bad. A sanitarian was immediately sent to the address to collect water samples. The health department had no knowledge prior to this call of anything amiss with the city water supply. Because of the broken sewer line and the characteristics of the water, it was thought that the sewage entering the bayou at this point was contaminating the water supply in the area.

The water samples showed that heavy coliform contamination was entering the city water supply in the area where the complainant lived. Eleven sanitarians went there immediately and began a search up and down the bayou for a possible cause of the bayou water entering the city supply. Within 2 hours they located the pump in the bayou.

Some dye was put into the pump line to ascertain if the material would eventually reach the city main. The dye was detected shortly afterward in all the outlets in Mr. X's yard and in the fire hydrant across the street.

As soon as there was proof of a direct connection between the bayou water and the city main, Mr. X was advised of the situation and asked to discontinue the use of the pump. He complied immediately. The city water department severed the cross-connection and disconnected the water main from the property. Beginning August 13, the sanitarians collected more than 300 water samples in the vicinity of the affected area and kept a continual surveillance of the water lines for chlorine residual. The people in the area were advised not to drink the water or else to boil it before use.

On August 14, health department nurses made a house-to-house canvass of the affected area for more epidemiological information. They found that approximately 70 persons had developed enteritis. The water supply was officially declared safe for use on August 28.

The data collected showed that 40 females and 32 males developed enteritis. Most of the cases occurred in children under 10 years of age, and in adults 35 years of age and over; only 2 were infants. The total of 72 cases, none fatal, occurred in 27 households whose population was approximately 125. The attack rate, therefore, was about 60 percent.

The cross-connection between the lawn sprinkling system and the public water supply may be considered as the initiating factor of the epidemic because of these circumstances:

1. All the cases occurred in households supplied by the water

NATCO INTRODUCES 2 NEW UNDERDRAIN UNITS...

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for improved performance in trickling filters

DESIGNED FOR:

Maximum efficiency
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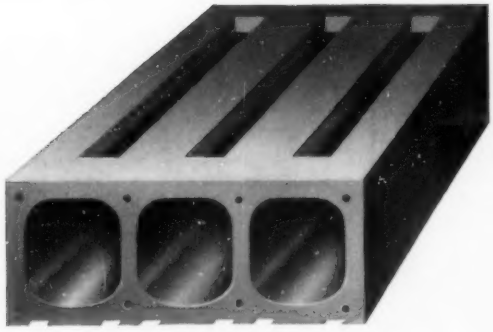
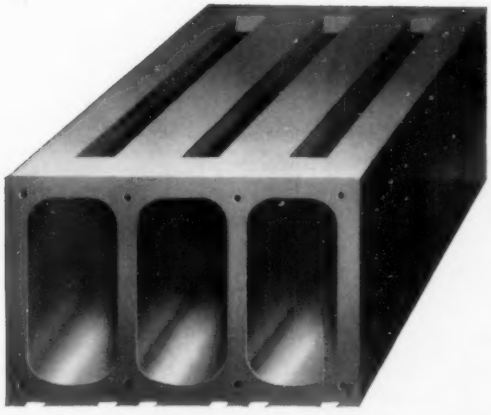
The new Natco vitrified clay TRI-FILTER block combines maximum capacity, both in drainage and aeration, with high strength, ruggedness, permanence and corrosion resistance, and all at minimum cost.

	Tri-Filter #5 Standard-Rate	Tri-Filter #8 Hi-Rate
Size	4¾" x 11¾" x 15½"	7½" x 11¾" x 15½"
Weight per unit	28 lb.	41 lb.
Weight per sq. yd.	196 lb.	288 lb.
Aeration per sq. ft.	39.3 sq. inch	39.3 sq. inch
Aeration %	27.3%	27.3%
Runoff sq. inch/lin. ft.	30.9 sq. inch	52.4 sq. inch
Runoff %	55.4%	59.3%



Tri-Filter #5
Standard-Rate



Tri-Filter #8
Hi-Rate

For additional information and shape details write to:

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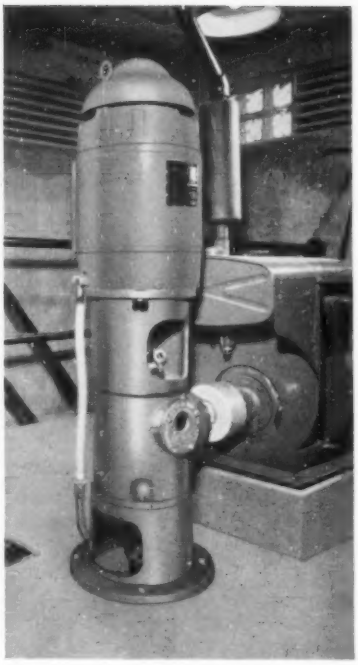

Cross State Development Co. installed the Johnson combination drive shown here in a sewage disposal plant in Florida. They report: "It's recognized as one of most efficient, packaged systems in the Tampa area. We've never experienced any difficulty." Neither will you because Johnson combination drive assures engine take-over the instant electricity fails. Either power unit may be overhauled without interrupting service.

Sizes: 15 to 450 hp. Johnson Right Angle Gear Drives are available in combination, dual and standard types; for all horizontal prime movers; hollow or solid shaft. Please write for engineering catalogs.

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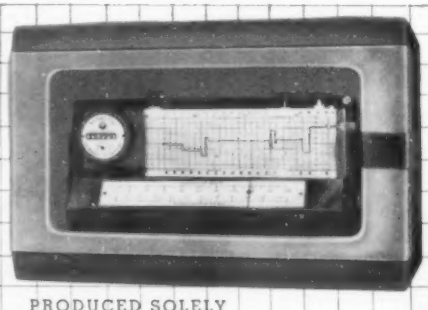

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main contaminated by the cross-connection. 2. The bayou water was heavily contaminated because of the sewer break near the property. 3. The dye test showed that the bayou water was reaching the city main in a relatively short interval. 4. The water pressure in the sprinkling system was greater than in the public water supply. 5. The gate valves in the sprinkler system line were frozen open, allowing the bayou water to flow into the public system. 6. The sewer break was corrected on August 8, and 3 days later the number of cases began to decrease. 7. The last primary case occurred 3 days after the cross-connection was severed and the water supply received increased chlorination.

In the neighborhood where the epidemic occurred, 206 water samples were taken from 69 residences. More than one sample was taken from most households; 62 of the samples were positive, 144, negative.

These results indicate that the contaminated water supply was the offending agent: Among households with no cases, twice as many had all negative samples (30) as had at least one positive sample (16); twice as many of the households with cases had at least one positive sample (15) as had all negative samples (8).

All 16 samples taken on August 11 and 13 were positive for coliform bacilli. After chlorination was begun and the cross-connection was severed, 1 sample in every 4 was positive. This ratio later decreased to 1 in every 5, and after August 23 no more positive samples showed up.

The specific offending agent of the epidemic remains unknown. A bacterial source is possible, but a viral agent, a sewage intoxicant, or a combination of offending agents is also plausible. That the vehicle of transmission of the offending agent was the bayou water is quite clear, and that the offending agent was associated with the sewer break is circumstantially evident.

If more information on water supply hazards had been exchanged between the local public utilities department and the health department, action to control the epidemic would probably have been quicker.

As a result of these events, the Shreveport City Council adopted an emergency ordinance requiring that all sprinkler systems be registered with the city plumbing inspector, and the plumbing board urged that the plumbing code be enforced to the letter.

Installed in Lake Isle Estates "Show House" near Scarsdale, N. Y.
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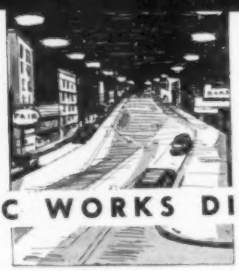


PUBLIC WORKS DIGESTS

Prepared by

FRANK FORCE

Associate Editor

THE HIGHWAY AND AIRPORT DIGEST

Stabilization of Sand With Asphaltic Materials

Greenville, Texas, has a method of street and highway construction that gives the smaller city or county an economical and serviceable pavement from materials which may be near at hand. In using asphaltic emulsion, one of the types that has been tried with sand found in Greenville is SS-1-H which is very close to the Federal Government specification of SS-1. The sand is placed in a windrow and thoroughly mixed by blading. In the mixing operations, the sand is measured by dump truck loads and placed on an abandoned street near the sand source. In this way, the quantity of sand is known and since the old street surface does not take up any of the asphaltic material during mixing operation, the mixture can be closely controlled. The sand must be at or slightly above optimum moisture before the emulsion is added. The sand is divided and about 10 gals. of emulsion per cu. yd. of sand is applied from a transport truck. The motor grader follows directly behind bringing in one of the windrows and starting the mixing operation. After this amount of emulsion has been thoroughly mixed into the sand, the operation is repeated until the total amount of emulsion in the sand is approximately 30 gals. per cu. yd. Application and mixing take about 4 hours before the finished mixture is ready for placement. The sand has also been used with RC-2 cutback asphalt and 20 gals. of RC-2 is used per cu. yd. of sand. The same mixing procedure is used.

"Stabilization of Sand With Asphaltic Materials." By James C. Duff, Director of Public Works and City Engineer, Greenville, Tex. PUBLIC WORKS, September, 1958.

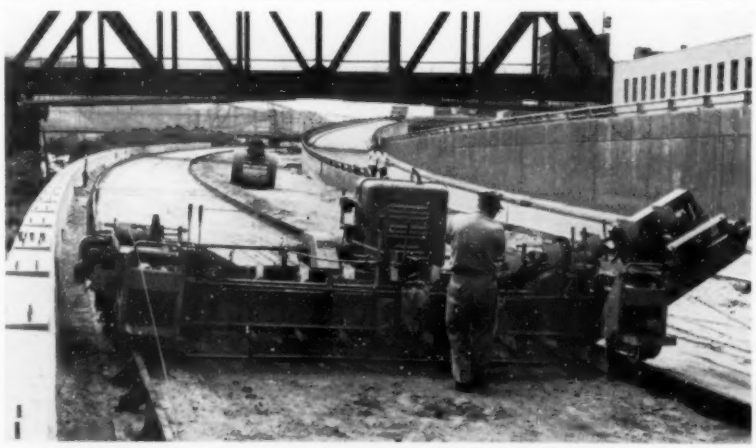
Stress Modern Management Tools in Urban County

St. Louis County, in the eastern part of Missouri, has an area of approximately 479 sq. mi. and a population of more than 600,000. The county is governed by 7 councilmen, each elected from a separate district for a 4-year term and a supervisor, who is elected at large for a 4-year term and who is the chief administrative officer of the county. The highway engineer also is an elected official for a term of 4 years. He is in charge of the highway division and has general supervision of the maintenance and improvement of roads and streets in the unincorporated areas of the county. There are approximately 700 miles of roads and streets under county maintenance. Funds for the maintenance and improvement of county roads are derived primarily from a tax on all real estate and personal property, with the total funds available being $2,067,000. For maintenance purposes the county has been divided into 5 districts, each with a district maintenance substation under the direction of a district supervisor. Each supervisor has 2 foremen, and each foreman is in charge of a crew ranging in size from 3 to 16 workers. From 6 to 11 trucks are operated in each district as well as a motor grader, roller, 2 high-lifts, 2 cinder spreaders, a pull broom, brush cutter, chain saw and a mower or two. A bridge crew consisting of a superintendent, a foreman and 14 workers are engaged on bridge maintenance throughout the county. A sign crew, consisting of 4 workers under 2 foremen, keep markings on county highways in accordance with the latest Bureau of Public Roads standards. The division maintains a public-information service and publishes each month a house organ that tells news about and for highway-division personnel.

"Stress Modern Management Tools in Urban County." By John J. Leslie, County Highway Engineer, St. Louis County, Clayton, Mo. *Better Roads*, August, 1958.

Slip-Form Paver Lays Reinforced Slab

A mile of reinforced concrete was placed on an Interstate Highway by a slip-form paver recently in Colorado. The slip-form paver or sled is fashioned into a large U. The outside members are 6-in. steel box girders. The open ends are attached to the forward arms of the paver by a 1-in. bolt and are on a ball-and-socket joint. The front end, welded to the box girders, consists of a 6-in. I-beam. Eight-inch wheels are attached under the forward corners, and two 6-in. wheels are placed under the center of the I-beam to facilitate the sled's forward movement. Running laterally between the box girders, and attached to the I-beam in front by hinged



● **CONSTRUCTION in Pittsburgh: Blaw-Knox subgrader is smoothing a 6-inch slag base, in a 14-foot wide pass, on a connecting link in Pittsburgh's "Point" area.**

MR. HORACE SHIRLEY TALKS ABOUT "OUR NO. 12"

Mr. Shirley is road superintendent for the town of Goffstown, N. H. He says:

"Our No. 12 is twelve years old and is in very good condition. There are over 20,000 hours of operation on it and in all this time we've never had a breakdown that held us up over three hours when it was supposed to be working.

"I believe that this is one of the finest pieces of equipment we have ever bought.

"We would not be able to keep our mountain roads open in the wintertime without the No. 12. Some of our roads up there have a twenty per cent grade. Sometimes the temperature goes to 35° below zero, and the motor still starts."

Now is the time to plan your fall and winter snow removal needs. Your Caterpillar Dealer will gladly give you any details you'd like—about the Caterpillar No. 12 Motor Grader—about matched snow clearing equipment. Call him today.

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Caterpillar Motor Graders can be equipped to meet your exact snow removal needs. Goffstown has its No. 12 equipped with a mast-type snow wing. Others use snow plow stub wings, Domor Snow Blowers, Omsteel V-type Snow Plows, or, if snowfall is light, motor grader bulldozers. Here in one machine is fast snow removal in winter and efficient road maintenance the rest of the year. Caterpillar Motor Graders offer you real year-around economy.

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joints, are eight 10-ft. runners. Accuracy of placement of the reinforcing steel was determined by cutting trenches across the width of the concrete at a point immediately behind the paver. Trenches were not dug to determine the placement of the heavy mesh, but the position was ascertained with a straight hoe. Variations did not exceed ½-in. either way from the 2-in. depth specified. The contractors placed an average of 2,000 ft. of 8″ x 24′ slab per day with non-reinforced concrete, and an average of 1,650 ft. per day working a 10-hour day, where reinforcement was required.

"Slip-Form Paver Lays Reinforced Slab." By George N. Miles, District Engineer, Colorado Dept. of Highways. *Roads and Streets*, August, 1958.

Continuously Reinforced Concrete

Continuously reinforced pavements in Texas are showing that they are comparable in cost with standard pavements when both construction and maintenance are considered, and they have exceptionally smooth riding surfaces. They are recommended for high-volume, heavy-duty pavements where interruptions for maintenance are costly and hazardous. Subgrades for these pavements should be of the same good quality as required for unreinforced pavements. Subgrades which are subject to swelling and have a potential vertical rise greater than ½-in. will require special treatment. Bases are used to prevent pumping at the pavement edge and are usually 6 to 8 ins. The pavement thickness is 8 ins. with continuous reinforcement. The amount of longitudinal reinforcing has beeen based upon experience and personal preference and has been not less than 0.5 percent. A minimum lap 20 bar diameters or one mesh is thought to be adequate and longitudinal bar spacing of not over 12 ins. is recommended for effective stress distribution. Transverse reinforcement is needed to keep the longitudinal center joints closed. Longitudinal joints are desirable to control longitudinal cracking and transverse joints are not required. Expansion joints are required only at ends of structures on which it is not feasible to carry the slab continously across.

"Case For Continuously Reinforced Concrete." By A. F. Beck, Resident Engineer, District 18. *Texas Highways*, August, 1958.

Requirements For Subdivision Approval

Richmond, Virginia's, subdivision ordinance provides that the City Planning Commission, or its duly authorized representative, shall approve the plat of a subdivision. A subdivision is defined as a division, subdivision or resubdivision of a lot, tract or parcel of land situated wholly or partly within the corporate limits of the city into 3 or more lots, tracts or parcels of land for the purpose, whether immediate or in the future, of transferring ownership of any one or more of such lots, tracts or parcels of land, or for the purpose of the erection of a building or buildings, or other structures on any one or more of such lots, tracts or parcels of land. When any and all conditions which may have been imposed by the Commission, as conditions of approval of any preliminary plans or plats have been complied with, and when the Directors of Public Works and Public Utilities have certified in writing to the Commission that all contracts and bonds required under provisions of the utility extension ordinance have been properly executed and delivered and are in force and effect, the Commission shall finally approve the subdivision plat.

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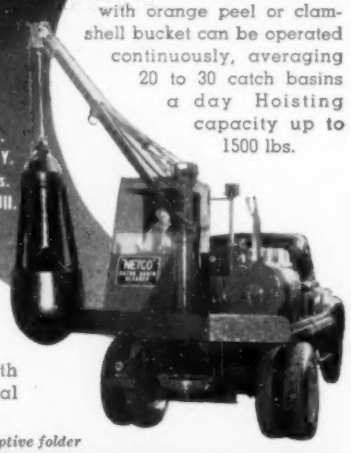

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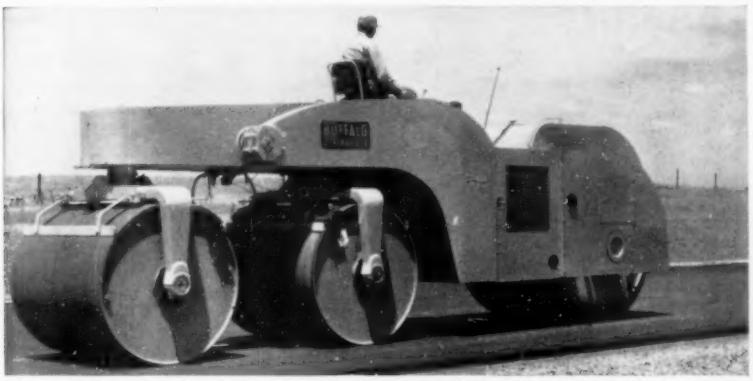

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For base fill compaction, the Buffalo-Springfield* self-propelled K-45 Kompactor* roller has proved a real money-saver. It operates on the "Interrupted Pressure Principle." All compaction is directed downward. Owners report that the K-45 meets density requirements in one-fourth the time normally required.

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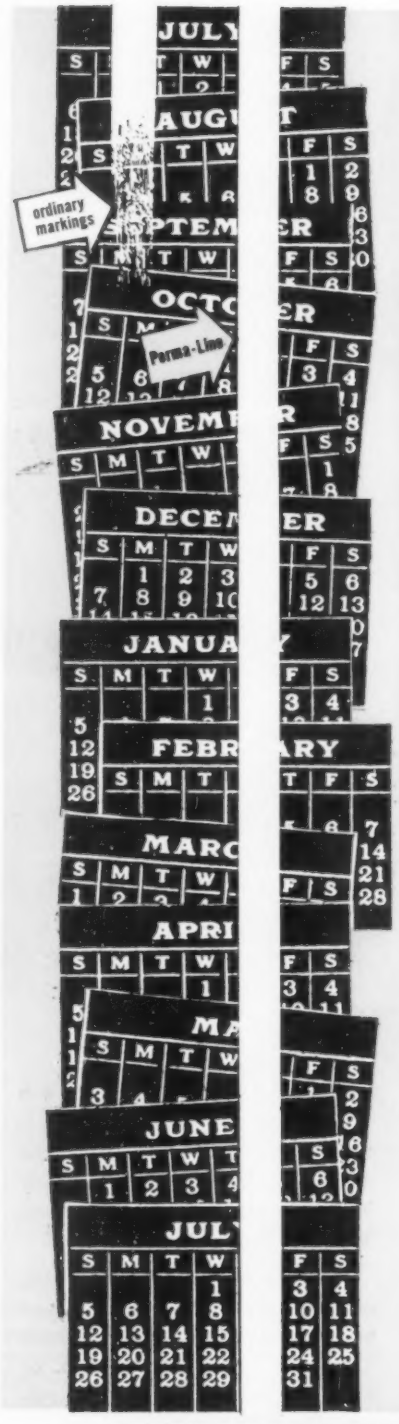
For complete information on all Buffalo-Springfield Rollers and K-45 Kompactor roller, see your nearest Buffalo-Springfield Distributor.



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The subdivider must then record the plat in the city court within 60 days from the date the plat is approved, otherwise the approval will expire. The problem of subdivision control concerns the metropolitan area rather than the city. The trend is toward more uniformity of requirements and application with the subdivider assuming more responsibility for providing the necessary improvements for service to the subdivision.

"Basic Requirements For Subdivision Approval." By George W. Cheadle, Div. of Preliminary Engineering, Dept. of Public Works, Richmond, Va. PUBLIC WORKS, September, 1958.

Traffic Signals in San Francisco

Placement of signal poles in San Francisco, Calif., at the intersection, and size, height and sequence of lights are uniform and in accordance with the "Uniform Manual for Traffic Control Devices" published by the Public Roads Administration and adopted by the California State Division of Highways. Signal lights are always installed on the curb line with additional signals when necessary at special locations, generally center islands. They are always located on the far right and left sides of the intersection although a near side signal may be added at the top of a steep hill. Special signal heads have ben designed for different locations. Special guide lines, 9 ins. wide, painted both within the intersection and approaching the intersection to inform the motorist of the proper operation are used to channel traffic. Guide lines completely through the intersection are particularly important when multiple turning lanes are necessary. There are 501 fixed-time traffic signals most of which are of the three-dial expansible type. Of these, 453 are interconnected into 20 signal systems. The balance of the 162 signalized intersections are operated by traffic actuated controllers and include semi and full-actuated types both of the density and non-density variety.

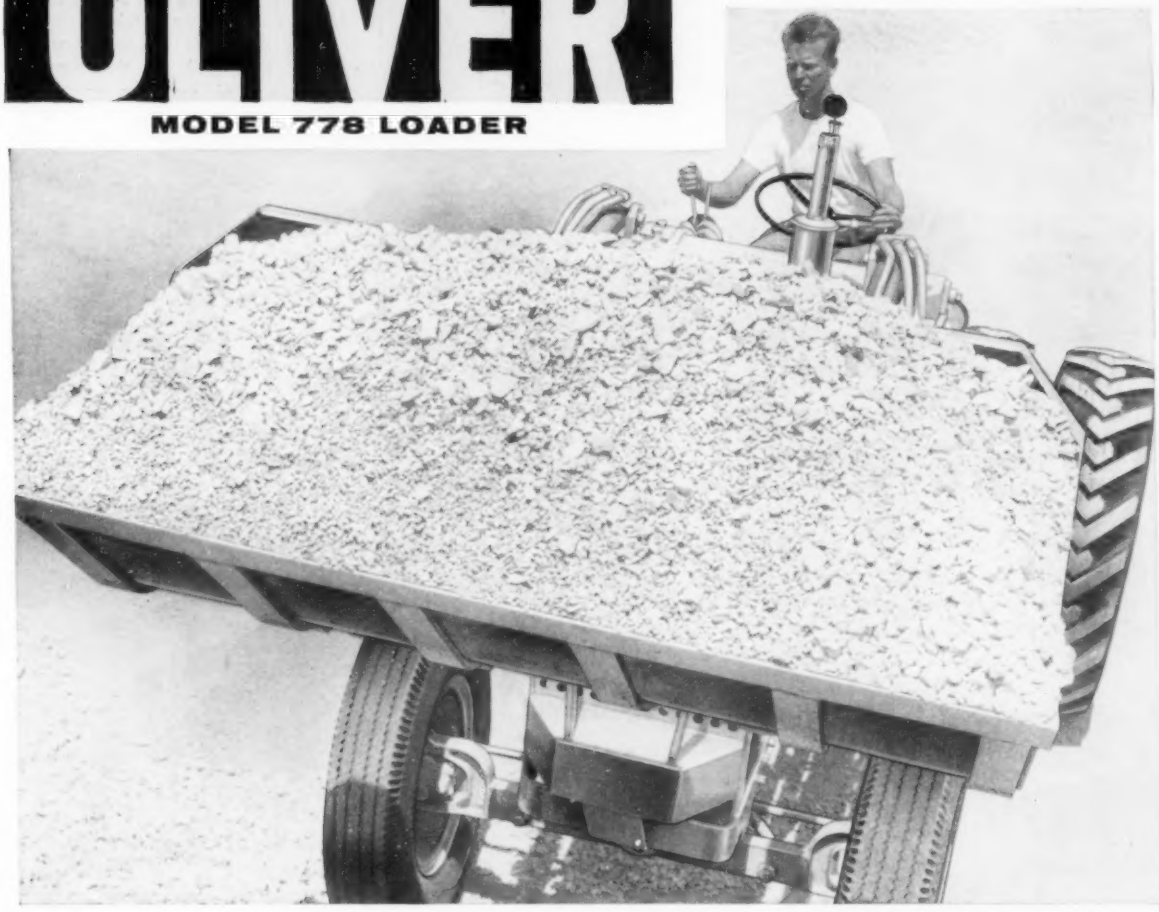
"San Francisco Puts 'Personality' Into Traffic Signals." By Ross T. Shoaf, City Traffic Engineer, San Francisco, Calif. PUBLIC WORKS, September, 1958.

Public Support Helped Syracuse Whip "Worst Winter"

Snowstorms began on January 2, in Syracuse, N. Y., and ran up a total of 124 ins. by Feb. 19. As soon

OLIVER

MODEL 778 LOADER



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Non-tiring operation does it! The most practical application of hydraulics and the most simple controls keep operators performing at peak efficiency even in day-long, nonstop production loading.

Step into your Oliver distributor's for the details and a demonstration.

It moves faster, loads more. The most spirited performance you ever saw in the ¾-yd. rubber-tired tractor-loader. The Oliver 778 is built to back up this speed for years. It's full-framed—the loader is mounted front and back for maximum strength. New detent valve feature holds lift arms up or down...new float position allows bucket to follow ground contour with no digging-in...bucket leveler is automatic. Works with many other attachments and in combination with trencher.

OLIVER **THE OLIVER CORPORATION**

Industrial Division, 19300 Euclid Ave., Cleveland 17, Ohio

a complete line of industrial wheel and crawler tractors and matched allied equipment

Outriggers down, this H-3 Hydrohoe uses the special utilities dipper to dig a 3-ft. wide 8-ft. long gas line inspection pit without stopping traffic on a busy street in Milwaukee, Wisconsin.

To give you a money-savin' edge . . .

HYDROHOE ON THE JOB— TRAFFIC ON THE MOVE

Bucyrus-Erie Hydrohoes dig trenches, manholes, valve pits, uncover leaks right in crowded streets and intersections *without blocking traffic.*

The short travel length permits easy moves in traffic. Stubby tail swing lets all-hydraulic Hydrohoes set up practically over a job site. Four power-operated hydraulic outriggers set in seconds to form a stable, level work base. The hoe swings inside its spread outriggers — no need for a flagman. The telescoping boom helps the hoe to load in close or far out with clean dump, in a position that doesn't block traffic.

Your Bucyrus-Erie distributor wants to show you all the reasons why traffic stays on the move with ½-yd. H-5 . . . and ⅜-yd. H-3 Hydrohoes on the job. 247H58

Other Hydrohoe money-savin' edges

- reverse the hoe dipper and you have a high production Hydroshovel
- quick as a small truck in traffic, open road speeds up to 50 mph
- precise, smooth hydraulic control and power
- choice of standard, wide, narrow or special utilities dippers
- extra attachments carried on the truck

BUCYRUS ERIE

Over 50% of Hydrocranes sold last year were repeat sales

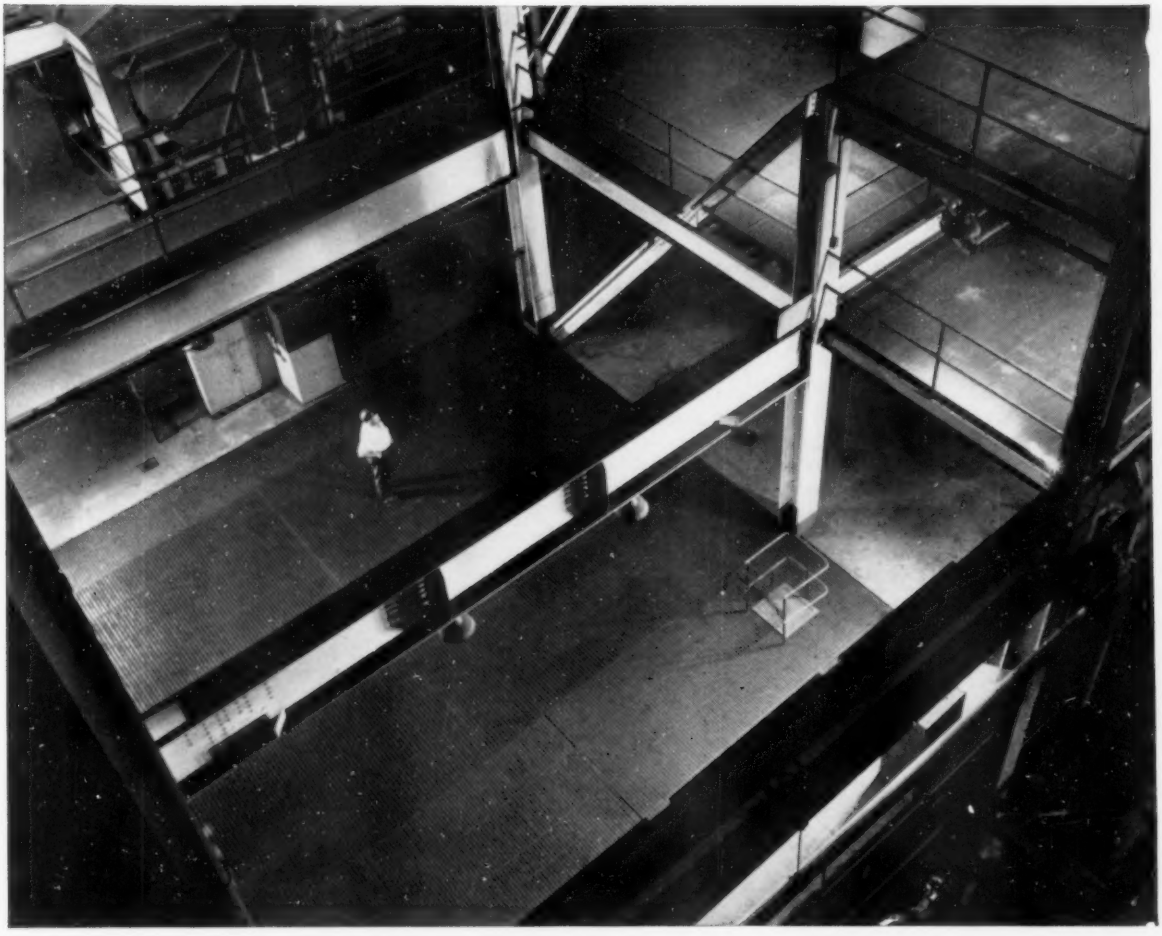
BUCYRUS-ERIE COMPANY • SOUTH MILWAUKEE, WISCONSIN

as trouble started, the Commissioner of Public Works called a meeting of his staff and they made a list of "should do" and "must" projects and concentrated on the "musts" until essential services were restored. The "musts" included hospital routes, bus routes and main arteries. Simultaneously a simple emergency parking plan was put into effect, followed by various temporary one-way routings, and the newspapers were called in to cooperate. The publicity effort included radio, TV and newspapers plus cooperation by local merchants and civic organizations. The snow removal procedure was based on 22 city plow routes and 35 ice control routes, and use of rented motor graders on 15 additional routes. The city's plow fleet consists of a SnoGo, 4 heavy motor graders with wings, rollover plows with double wings, nose plows and numerous underbody blades. The downtown area was kept open by using 6 or 8 plows in batteries under police escort and plowing in tandem. A square mile area was covered in 1½ hours, and the plows, trucks and loaders worked in the direction of traffic.

"Public Support Helped Syracuse Whip Worst Winter." *Street Engineering*, August, 1958.

Slurry Seal As a Dollar Stretcher

Rochester, N. Y., maintains a complete condition survey of its city streets. All pavements are classified from A to H, according to their condition and each year the records are checked and changed. In 1956, the city initiated the slurry seal method of pavement maintenance. A 2-bin, 20-ton batching plant was purchased along with storage tanks for the emulsified asphalt. A measuring device was made with an adjustable standpipe to measure the emulsified asphalt for each batch. An 8 x 10-ft. spreading box using aluminum sections with steel runners was used to lay the seal. The inside of the box was lined with rubber flaps. The method of construction is as follows: 1) After patching, the street was thoroughly flushed with flusher nozzles turned down to clean out the cracks; 2) following a short drainage period, power sweepers swept the gutters and the cracks were blown out with air; 3) street was again flushed early in the morning before sealing to leave a damp surface; 4) a truck mixer drawing the sealing box handled actual sealing operations; and 5) the streets were left



Blaw-Knox Electroforged® Steel Grating provides removable floors to simplify plant operation

Floors and mezzanines made of Blaw-Knox grating solve the problem of reaching, moving and servicing the largest types of equipment. Sections come up easily, allowing ample space to maneuver and maintain any size of machinery. Costly, time-consuming alterations are virtually eliminated.

For increased plant safety Blaw-Knox Electroforged Steel Grating provides rigid one-piece construction for sure support of the heavy loads. Non-slip cross bars and a wide variety of bearing bars assure safe walking and climbing — even under the most hazardous working conditions.

Because there's nothing to wear, or patch, nothing to catch and retain dirt, upkeep becomes easy and economical. And grating's maximum open area admits more air and light, makes brighter, better-ventilated plants.

Blaw-Knox Electroforged Steel Grating for walkways, stair treads and floors is fabricated to meet your specific operating needs. For new ideas about a complete line of space saving grating, write for Bulletin 2527 featuring grating and treads.

BLAW-KNOX

BLAW-KNOX COMPANY

Equipment Division
Dept. W, Pittsburgh 38, Pennsylvania

barricaded for 2 to 4 hours. The average cost per sq. yd. of this maintenance is $0.08.

"Slurry Seal as a Dollar Stretcher." By Walter Hughes, Executive Director, Dept. of Public Works, Rochester, N. Y. *The American City*, August, 1958.

Pore Pressures in Base Courses

Although it is desirable to keep roadway base courses dry, they usually get wet in spite of efforts to prevent entrance of water or to provide drainage. However, the stability of granular material depends more on the state of stress in the pore water than on the amount of water present. A load applied to wet soil (total pressure) is carried between the soil grains (intergranular pressure) or on the water (pore pressure). Since the strength of soil depends upon the intergranular pressure, any pore pressure reduces the strength because the intergranular pressure equals the total pressure minus the pore pressure. Therefore, measures which prevent the development of pore pressures may maintain the stability of a base course even though the material stays wet. This requires minimizing the amount of fines without making a material too harsh to place with a uniform high density.

"Pore Pressures in Base Courses." By Edward S. Barber and George P. Steffens, Highway Physical Research Engineers, Bureau of Public Roads. *Public Roads*, August, 1958.

Highway Lane Striping

Michigan Highway paint crews are moving quickly toward completion of their 7,500-mile pavement marking chore. The crews have averaged 200 miles a day of paint striping on state primary routes. Single crews have been able, in some cases, to average 25 miles a day. Last year, more than 120,000 gallons of white, black and yellow paint were used, and the entire job, including labor, cost $468,500. The Department currently has 10 crews, each consisting of 6 men and 3 vehicles, working on paint striping. Each crew consists of 3 two-man teams. The spray truck takes the lead, followed by a team which places the cone-shaped traffic barriers along the freshly painted lines. A third truck follows about 3 miles behind the sprayer, picking up the cones and transferring them to the second vehicle. All 3 vehicles must travel at a constant rate of speed, usually about 6 miles per hour, depending on the paint drying conditions. The paint now used will dry in about 30 mins. The painting procedure alternates a 20-ft. long white line with a 30-ft. long black section. Yellow no-passing lines are painted wherever driver visions are limited to 1,000 ft. or less. About 12 gals. of paint are needed for a mile of centerline, plus about 36 lbs. of beads.

"Highway Line Painters Hurry to Complete Annual Half-Million Dollar Spruce-up Job." *Michigan Hy-Lighter*, July, 1958.

Other Articles

"Downtown Parking Garage Handled 142,313 Cars in Nine Months." City of Saginaw, Mich., has a parking structure that occupies almost a complete city block with only a 120-ft. x 142-ft. rectangle missing from the total block of 240-ft. x 365-ft. size. It is of a continuous ramp design of three stories. By James W. Federhart, City Traffic Engineer, Saginaw, Michigan. Public Works, September, 1958.

"Curb, Gutter and **Sidewalk Repair** Program." Glendora, Calif., is solving the problem of sidewalk and curb

(*Turn to page* 209)

ONE MAN Operates Snow Plow From the Cab . . . AUTOMATICALLY!

POWER MONARCH HYDRAULIC CONTROLS

Instant action! Snow removal is easier, faster, more efficient. Automatic snow plow operation right from the truck or jeep cab. Battery-Operated or Fan-Belt Driven Models. See your dealer or write for full information.

MONARCH ROAD MACHINERY COMPANY
1331 Michigan St., N. E. — Grand Rapids 3, Michigan

HERE'S the GREATEST TRAFFIC SIGN VALUE in AMERICA

"EZ-ON"®

SIGN FACES BY GRACE

ATTACHES IN LESS THAN 5 MINUTES!

"EZ-ON" Faces, slip on right over present signs. Your signs are never out of service. Standard regulatory and warning copy—in red and white, yellow and black. They meet every need at ½ the ordinary cost!

2 SIZES—2 SHAPES—REFLECTORIZED

"EZ-ON" Faces are made in 24 and 30 in. sizes, octagon and diamond, of light gauge steel, flanged to easily clamp over old signs. Fully reflectorized, they serve night and day meeting all specifications for durability, brilliance and reflective qualities.

SEND IN A TRIAL ORDER

Yes, 2 signs for only $5.00 . . . a special offer. A trial will convince that "EZ-ON" Faces are the answer to traffic sign costs and maintenance.

2 SIGNS FOR $5.00

SPECIAL OFFER

TRY THEM AND SEE FOR YOURSELF

GRACE SIGN & MFG. CO.
3601 S. 2nd ST.
ST. LOUIS 18, MO.
Dept. WP

KILLER IN THE DARK...

This is a warning sign that didn't warn . . . a sign that went "off duty" at dusk . . . and became a "*Killer in the Dark!*"

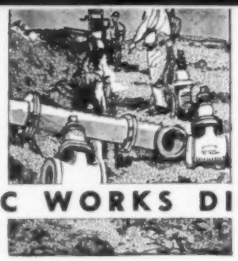
Better think twice about using such signs. Non-reflectorized, they provide no protection for night drivers . . . give no warning of impending disaster that may lie only moments away. Many have perished because of them . . . more will die this year. How many will fall within your scope of authority?

Cataphote Reflective Traffic Signs *and* Street Name Signs can play a major role in your fight for safer streets and highways. Extreme durability makes them economical, too. Cataphote's method of reflectorization protects the sign . . . provides longer life . . . at a cost far below other methods.

Write for complete information today . . . and remember, when safer signing is installed, someone will get the credit. Will it be you?

Cataphote
CORPORATION
TOLEDO 10, OHIO / JACKSON, MISSISSIPPI

Manufacturers of: CATAPHOTE REFLECTIVE BEADS • CATAFLEX REFLECTIVE COATING • CATALINE REFLECTIVE STRIPING
CATATHERM REFLECTIVE PLASTIC STRIPING • TRAFFIC SIGNS • STREET NAME SIGNS



PUBLIC WORKS DIGESTS

Prepared by
ALVIN R. JACOBSON, Ph.D
Associate Professor and Head,
Division of Sanitary Science,
Columbia University School of Public Health

THE WATER WORKS DIGEST

Split Flow Treatment

In 1955, the City of Eau Claire, Wisconsin, completed the construction of a much-needed iron and manganese removal plant. The original plant design consisted of two 12 mgd Dorr-Oliver Hydro-Treators, followed by four rapid sand filters each having a capacity of 6 mgd. The plant was designed for use with a coagulant aid, but water treatment problems arose almost immediately due to the chemical composition of the raw water which varied from well to well. After considerable study of the problem, it was recommended that a split flow treatment method be inaugurated. This process consisted of treating water from those wells containing iron and manganese in upflow coagulation basins and mixing the effluent with untreated water from other wells. Mixing of the raw and treated water was accomplished by installing a baffle wall in the influent flume which provides a mixing area. Recarbonation was accomplished by installing a unique carbon dioxide diffuser at the inlet to the mixing flume from the basin being used as a treatment unit. Savings have been calculated to be more than $40,000 a year. This figure includes savings in chemical purchases, the greatest saving being carbon dioxide, plus the savings in operation and maintenance of feeding equipment that would normally be used if the total water produced was treated.

"Split Flow Treatment." By Lloyd V. Owens. *Water and Sewage Works*, August, 1958.

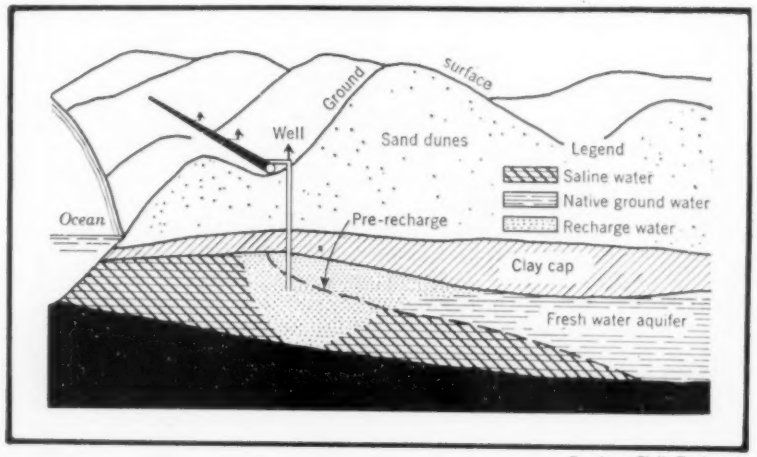
Ground Water Recharging

In southern California the local ground-water basins are seriously overdrawn and supplemental supplies are imported from the High Sierras and the Colorado River over distances of more than 250 miles. It has been shown that 20 out of 35 ground water basins along the coastal margins are suffering from serious sea-water intrusion, or are in immediate danger from it, and that the other 15 are potentially subject to degradation. One of the many water conservation measures being considered by the Los Angeles County Flood Control District is the salvage of flood and other waste water and protection of ground water. To summarize, the various tests that have been carried out show that where enough land of proper infiltration characteristics is available, trickling-filter-plant effluent can be spread economically so as to create no pollution to the ground water when the latter is more than 7 ft. below the surface; and that high-rate activated-sludge effluent, generally varying from 30 to 80 ppm in suspended solids and BOD, can be sufficiently treated through special spreading techniques to furnish a percolate which, when chlorinated, can be injected into a well, with no important maintenance problem and without polluting the ground water.

"Recharging Ground Water with Reclaimed Sewage Effluent." By F. B. Laverty. *Civil Engineering*, August, 1958.

Experiences With Recycling Drinking Water

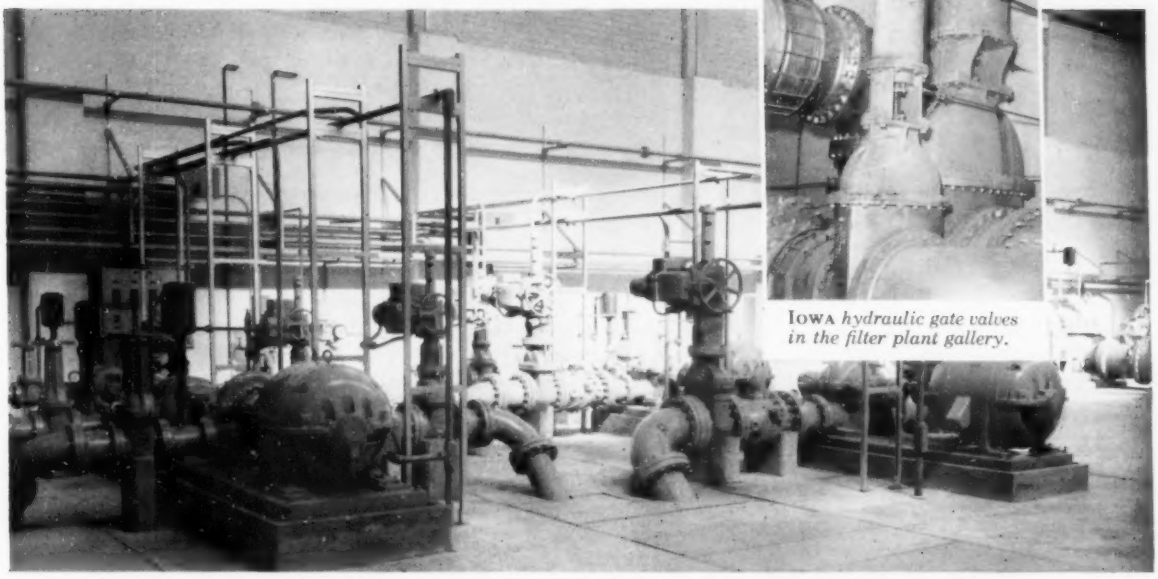
As a result of severe drought, Chanute, Kansas, undertook recycling sewage plant effluent for potable water use for five months in the fall and winter of 1956-57. The sewage plant involved standard trickling filter treatment with a loading of 800 lbs. per acre-foot per day. Postfiltration chlorination was not started until two months after recycling was commenced. The sewage plant effluent was discharged to the raw water reservoir which acted as a stabilization pond with a retention period of 17 days. The water treatment plant involved conventional facilities for softening by high lime treatment and recarbonation. Difficulties encountered at the water plant included inability to use free residual chlorination for taste and odor control and color removal, frothing in the recarbonation basin, clogging of filters, less effective coagulation and settling, and false high readings in colorimetric determinations for chlorine residual. In addition, a build-up of total solids, chlorides, and sulfates occurred. The coliform content of the raw water was less than that found in the normal source of supply, the Neosho River, for the same period. The tap water met USPHS Drinking Water Standards for bacteriological quality. Algae concentrations were high and were difficult to reduce by treatment. While amoeba cysts were low in concentration, the treatment plant was not efficacious in removing

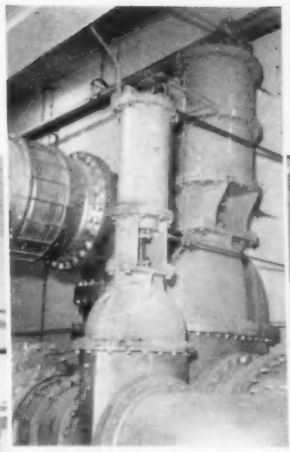


Courtesy Civil Engineering

● SALINE intrusion into fresh water aquifer is blocked by recharge through well, forming a barrier. The diagram above shows how recharging program operates.

40 IOWA GATE VALVES...





IOWA *hydraulic gate valves in the filter plant gallery.*

IOWA *motor-operated gate valves installed in the main pump station of North Texas Municipal Water District. (General Manager: Mr. A. P. Rollins; Consulting Engineers: Forrest and Cotton; Design Engineer: Mr. Ormond A. Stone.)*

Control delivery of
20 million gallons of water a day
for the North Texas Municipal Water District

• Forty IOWA Hydraulic and Motor-operated Gate Valves—from 4" to 30" sizes—are used in the Filter Gallery and High Lift Pump Station of the North Texas Municipal Water District, supplying 10 North Texas Municipalities and the District's largest customer, the City of Dallas. Additional IOWA gate valves are used in the six pumping plants operated by the district.

The Filter Plant, located at Wylie, Texas, has a capacity of 20 million gallons a day. However, the design is such that it can operate safely at twice this amount. Water is delivered to the ten member municipalities and the City of Dallas through 90 miles of transmission line, ranging from 12 to 42 inches in diameter.

This Texas application is typical of the ability of IOWA to furnish gate valves to meet the most exacting specifications for plant and distribution service. Be sure and check the wide variety of IOWA valves, accessories and specialties before you place your order.

Let us send you details on Iowa's complete line of valves and hydrants

IOWA
VALVE COMPANY
A Subsidiary of James B. Clow & Sons, Inc.
Oskaloosa, Iowa

SPECIAL DELIVERY for liquids and gases in all branches of industry is assured with Kraloy Rigid Polyvinyl Chloride (normal and high impact) Plastic Pipe . . . with virtually no maintenance or policing. You install Kraloy PVC—and forget it. That's why millions of feet of Kraloy Plastic Pipe are in use today, because Kraloy PVC is inert and can never rust, rot, or corrode, is not subject to electrolytic action, handles abrasives, slurry and most Ph factors, is scale resistant. Superior flow characteristics (C factor = 150+) permit use of smaller diameters. Installation costs 50% less, due to light weight and ease of handling.

Write for complete information and literature.

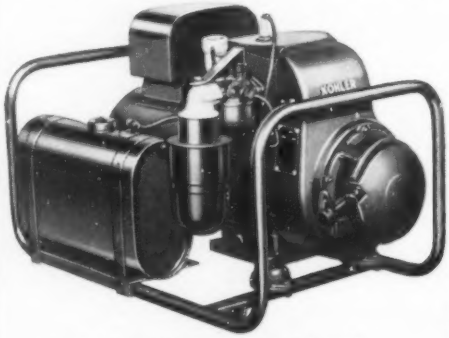
KRALOY ID PVC PLASTIC PIPE NORMAL AND HIGH IMPACT

Kraloy Plastic Pipe Co., 4720 E. Washington Blvd., Los Angeles, Dept. PW-108

Subsidiary of the Seamless Rubber Co., a Rexall Drug Co. *Subsidiary*

KOHLER ELECTRIC PLANTS

Ready, reliable on-the-job electricity



Use time-saving portable Kohler electric plants for floodlights, power tools, on sewage, water main and street repair jobs. When regular electricity is interrupted, Kohler plants keep sewage treatment and water filtration equipment operating. Sizes: 500 watts to 100 KW gasoline, 10 KW to 100 KW diesel. Write for folder B-37.

Model 2.5MV55, *2500 watts, 180 cycle, 230 volt, 3 phase A.C; with combination 115 volt D.C. Manual start.*

KOHLER CO. *Established 1873* KOHLER, WIS.

KOHLER OF KOHLER

Enameled Iron and Vitreous China Plumbing Fixtures • Brass Fittings
Electric Plants • Air-cooled Engines • Precision Controls

them. Examinations for virus showed their presence in the raw water but none in the treated water. Public acceptance was poor, but there were no known harmful effects on public health. It was concluded that the reuse of sewage plant effluent should not be attempted except under the most severe emergency conditions.

"Emergency Use of Reclaimed Water for Potable Supply at Chanute, Kansas." By D. F. Metzlar, R. L. Culp, H. A. Stoltenberg, R. L. Woodward, Graham Walton, S. L. Chang, N. A. Clarke, C. M. Palmer, and F. M. Middleton. *Jour. AWW Ass'n.*, August, 1958.

Small Meter Maintenance

The Hackensack (N.J.) Water Co. has carried on an extensive study of their meter servicing program over the past 25 years. This study has resulted in major changes in meter servicing methods and schedules and a resultant saving of $50,000 per year in this important function of the water utility. Prior to 1930 the Company had been using piston-type meters with the inside of the cast iron being tinned or painted. From 1932 to 1943 the inside bottoms of the casings were enameled to inhibit corrosion caused by dissimilar metals. By 1943, it was found that carburizing was more effective than enameling and was adopted as company policy and is being used at this time. During this same period, the company was revising its meter servicing schedule from a period of 7 years to a period of 10 years in 1942, and finally to 15 years in 1953. Unaccounted-for water has decreased from 14.43 percent in 1942 to 9.55 percent in 1957. All incoming meters are tested at 20, 8, 3, 2, 1, ¾ and ¼ gallons per minute flow rates. The accuracy of registration of the meters has been improved and an increase in accounted-for water has been achieved. The $50,000 reduction in operating expenses and improvements in performance have been accomplished in spite of a rising market for labor and materials.

"Converting Small Meter Maintenance From a 7-Year to 15-Year Schedule." By C. J. Alfke. *Water Works Engineering*, August, 1958.

City-Industry Cooperation

In 1954 the City of Everett, Wash., was faced with a serious problem of supplying sufficient water to two of its largest customers that required

1 gram = 800 square yards

. . . 120 billion taste-traps!

AQUA NUCHAR

ACTIVATED CARBON FOR TASTE AND ODOR CONTROL

Every gram of AQUA NUCHAR contains 120 billion particles of activated carbon with a surface area exceeding 800 square yards!

This amazing fact spells economy and effectiveness in controlling water tastes and odors.

Since AQUA NUCHAR has strong surface affinity for all taste- and odor-forming substances, extremely low concentrations can solve any odor-taste problem that arises. When finely dispersed, the light, porous particles deodorize your water and leave it clear and palatable.

By varying the dosage to meet the need, as dictated by daily threshold odor tests, you can be sure of consistent PALATABILITY, day after day.

Our field technical service staff will be glad to survey your requirements with no obligation on your part.

A short note from you is all we require.

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FILTER SAND AND GRAVEL

A high grade of silica material hydraulically produced to meet specifications for effective size uniformity coefficient and exacting chemical requirements.

Prompt shipments from plants located in Roslyn, N. Y., and Port Jefferson, N. Y.

William J. McCormack Sand Division

Penn Industries, Inc.

136 East 57th St., New York 22, New York

MUrray Hill 8-9200

HEAVY-DUTY
ELLIS PIPE CUTTER
FOR CUTTING LARGE SIZE PIPE

Drop-Forged Frame and Links

Long-Lasting Cutter Wheels

Makes a Hit With Water Works Men

Cuts Pipe In or Out of Ditch

TWO SIZES

No. 01 for 4" to 8" Pipe
No. 1 for 4" to 12" Pipe

Write for Circular and Price List No. 40PW

ELLIS & FORD MFG. CO.
FERNDALE 20, MICH.

about five times as much water as all the rest of the customers combined. In spite of the existence of many serious road blocks, including a contract which did not expire until 1960, a new long-term contract was negotiated between the City and large customers. The problem was solved by both sides sitting down and striving to achieve an understanding which was mutually profitable to all concerned. The new 25-year contract (principal features are given in article) assured the City of adequate revenue to make the necessary expansion and improvements to the water system that would assure the customers of an adequate supply for the foreseeable future. The amicable solution of this problem proves that industry and domestic users can support a city water system within the limits of both their financial abilities, with neither group being imposed upon by the other.

"City-Industry Cooperation Makes Adequate Water Supply Possible." By Homer Hathaway. *Public Works*, September, 1958.

Other Articles

"How A **Watershed Program** Can Be Developed For a Community." Public Law 566 has given local citizens the opportunity of establishing water conservation programs with the help of the Federal government. Public Works, September, 1958.

"Plastic Linings and Coatings for Steel Water Pipe." A review of plastic materials and processes available for coatings and linings indicates that many are too expensive, but 10, 15 or 20-mil coatings can provide the necessary degree of protection and be competitive in cost with methods now used. By G. E. Burnett and C. E. Selander. Sewage and Industrial Wastes, August, 1958.

• • •

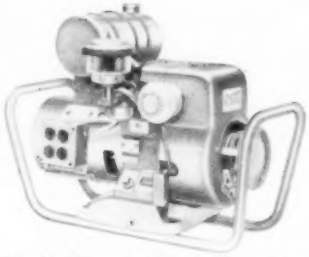
Bucket Life in an Incinerator Installation

Over its 18 years of service, the incinerator of Pittsburgh, Pa., has handled an average of 200,000 tons of refuse annually. To maintain this rate of processing the plant uses two pit cranes 24 hours a day, seven days a week. The clamshell buckets operating from the cranes have given outstanding service. In 1940 two Blaw-Knox 7201, rated 2 cu. yd., incinerator type clamshells were put into service. A third was stocked as a spare. Four more buckets have been purchased since then, including one in 1957. All new buckets are Blaw-Knox size No. 7201.

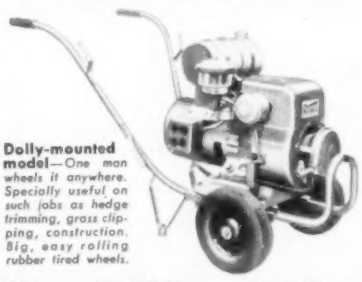
Together the buckets have handled 3,600,000 tons of refuse.

Onan
ELECTRIC PLANTS

ELECTRIC PLANT
NEWS



Carrying frame model—*Lightweight tubular aluminum frame for one or two-man carrying. Easily lifted in and out of pickup or around on the job site.*



Dolly-mounted model—*One man wheels it anywhere. Specially useful on such jobs as hedge trimming, grass clipping, construction. Big, easy rolling rubber tired wheels.*

New 1500 watt D.C. Onan Electric Plant

Here's more efficient portable power for all 115-volt D.C. and universal motors or tools and equipment. This new Onan power package, Model 115AK-115M, gives you more power per pound of electric plant, more power per gallon of gasoline. Recommended specially for turf maintenance, emergency rescue service, and fire department use.

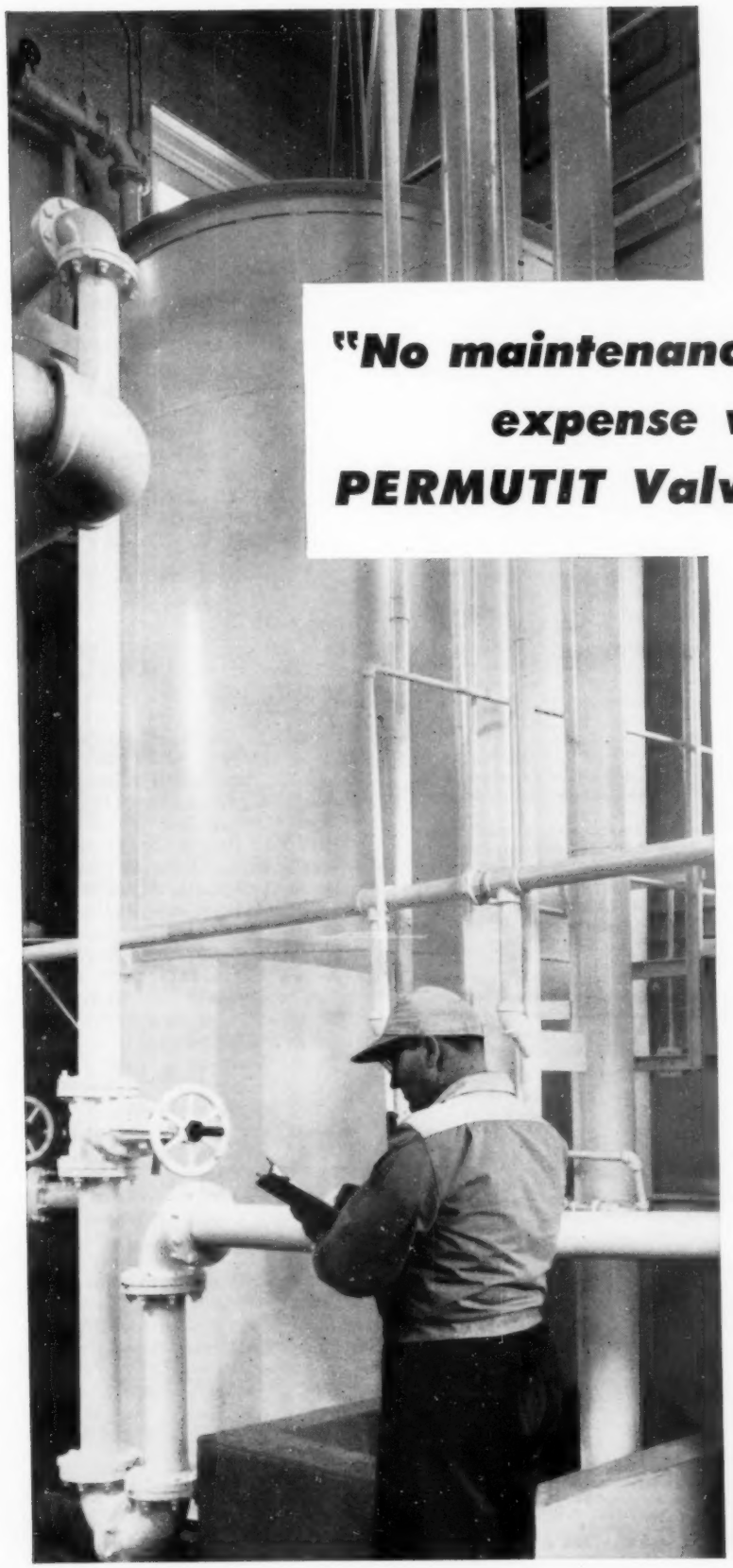
Direct-connected, compact design

Rugged, single-cylinder, 4-cycle, Onan air-cooled engine starts quickly in any weather. Heavy-duty splash-proof generator is direct-connected to engine, making a rigid, compact, long-life unit. Standard equipment includes manual starter, oil-bath air cleaner and 4 plug-in receptacles. Carrying frame, 2-wheel dolly and recoil starter are optional at low cost.

Standard Model *For installation in maintenance trucks, on fire rigs etc. Converts to portable model with carrying frame or dolly.*

See your Onan distributor or write for information

D. W. ONAN & SONS INC.
3682A University Avenue S. E.
Minneapolis 14, Minnesota



One of two Permutit Automatic Valveless Water Filters at O. M. Scott & Sons Co. Chemical Products Plant, Marysville, Ohio. Each filter is 7' diam. and rated at 116 gpm. The complete Permutit water-treatment system was engineered by H. A. Williams and Associates, Columbus, Ohio.

"No maintenance or operating expense with our PERMUTIT Valveless Filters"

- These filters have been operating continuously for over a year and a half . . . supplying water for process, boiler feed and drinking. They follow a Permutit Precipitator that treats raw well water with lime, soda ash and coagulants. Either filter can handle full feed rate during inspection or repairs on the other.

- Here's how Glenn L. Moll, Scott's Service Manager, puts it: "Our Permutit Automatic Valveless Filters are operating very satisfactorily. The filter-bed and underdrain system stay clean with no evidence of blow holes or sifting of filter media to the underdrain system. We now inspect them only twice a year."

- The Valveless Filter is completely automatic—yet costs up to 45% *less* than conventional automatic gravity filters because it uses no expensive valves, flow controllers, pumps or hydraulic or pneumatic control systems.

Send for descriptive bulletin. Address: The Permutit Company, Dept. PW-10, 50 West 44th Street, New York 36, N.Y. or Permutit Company of Canada, Ltd., Toronto 1, Ontario.

PERMUTIT®

rhymes with "compute it"

A DIVISION OF PFAUDLER PERMUTIT INC.

Water Conditioning

Ion Exchange • Industrial Waste Treatment

Municipal Water Filter Installation cost can be cut 1/3 to 2/3 with...

★ This Filter is also used extensively for swimming pool and industrial plant water filtration.

SPARKLER *Diatomite* **FILTERS**

Engineers in charge of new Municipal Water Works filtration systems are more and more favoring the SPARKLER DIATOMITE FILTER MODEL RJ because:—

1. The original cost of a diatomite plant for public supply is ¼ to ⅓ the cost of a sand plant of equal capacity.
2. Diatomite filtration reduces bacteria and removes organic matter to an exceptionally high degree with attendant low chlorination requirement. This results in reducing consumer complaint due to chlorinous tastes.
3. Turbidity less than 5 P.P.M. can easily be maintained at all times even though the raw supply fluctuates greatly. Channeling, mud balling and other common sand filter shortcomings are never a problem.
4. Operating cost compares favorably with conventional sand.
5. Sparkler Filters can be used with pretreated water when such treatment is necessary or desirable.

Sparkler filtration engineers have introduced, in the RJ filter, new principles of diatomite filtering that are much superior to old methods and comprise the most advanced developments in recent years.

Less than 0.2% of the harvested filtered water is required to sluice and clean the Model RJ filter. The largest filter units can be cleaned and a new fresh diatomite pre-coat applied and the filter back in operation in 20 minutes or less.

Operators can be easily trained to handle this filter, highly skilled specialized personnel is not required to insure efficient performance.

Sparkler Model RJ filters can supply practically any required volume of city water. Single units with a capacity of 2,000,000 gal. per day are available. Multiple units including a standby filter is usually employed to insure uninterrupted service for large volume requirements.

Modern electronic control instruments are readily adaptable to these filters, making uniform high quality water supply sure and automatic.

The startlingly low original cost, simple operation, and positive, consistent high quality filtration makes the Sparkler Municipal Water Works filtration system worthy of the most thorough consideration by water works engineers.

SPARKLER FILTERS

SPARKLER MFG. CO., MUNDELEIN, ILL.

Sparkler International Ltd. with plants in Canada, Holland, Italy and Australia — Service representatives in principal cities throughout the world.

FILTRATION ENGINEERING AND MANUFACTURING EXCLUSIVELY FOR OVER 35 YEARS.

SEWAGE TREATMENT, SEWERAGE and WATER WORKS CONTRACTS in 1957

CONTRACTS awarded for sewage treatment works, collecting sewers and water works in 1957 amounted to $1,054,000,000 according to data obtained from a study by the Public Health Service. Of this, $351.2 millions were for sewage treatment works; $246.6 millions for collecting sewers; and $456.6 millions for water works. These are actual dollar figures which are somewhat reduced by conversion to 1955 dollars, the standard of comparison frequently used.

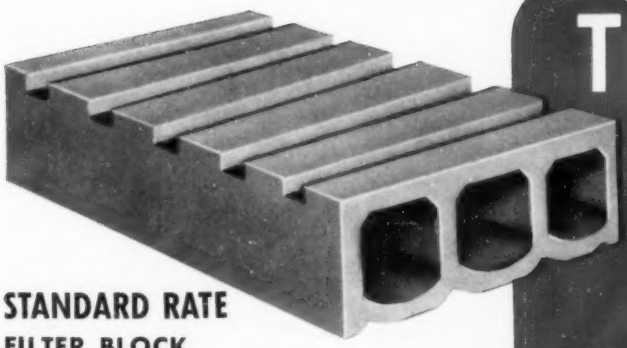
Awards throughout the year were fairly uniform but generally lower in the early months for sewers and sewage treatment.

Sewage Treatment

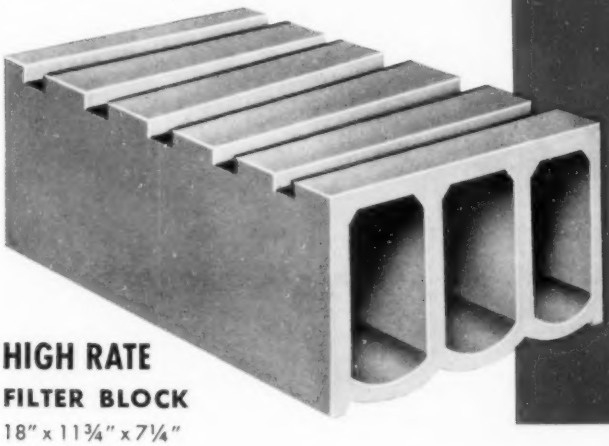
Contracts were awarded for 1150 sewage treatment plants in 1957, of which 445 were new plants and 705 were for interceptors, outfalls, additions, enlargements and alterations. Of the plants, 47 were of unknown size; of these, 18 were new plants costing $7,053,000. There were 66 plants serving populations under 500 and costing $2,693,000, of which 39 were new plants costing $1,772,000. Comparable figures in other sizes were: 500 to 1,000 population, 108 plants, $6,916,000 total, of which 61 were new and cost $4,052,000; 1,000 to 2,500 population, 220 total plants, $24,868,000 with 107 new plants, $14,116,000; 2,500 to 5,000, total plants 138, costing $29,575,000 of which 63 were new at a total of $15,668,000.

In the range over 5,000 population, there were 130 plants, 48 of them new, in the 5,000 to 10,000 bracket, average cost for all plants $238,000 and for the new plants $350,000. There were 145 plants in the 10,000-25,000 population group, the 44 new plants costing an average of $450,000 each. There were 83 plants, 23 of them new, in the 25,000 to 50,000 range, the new plants averaging $610,000 each. There were 42 new plants among the 213 projects for cities over 50,000 population.

Data are available on size of contract awards. There were 80 contracts awarded for less than $10,000 each, the average being about $5,300. There were 142 contracts for $10,000 to $25,000 each; 135 between $25,000 and $50,000; 201 between $50,000 and $100,000; 298 from $100,-



STANDARD RATE
FILTER BLOCK
18" x 11¾" x 4¼"



HIGH RATE
FILTER BLOCK
18" x 11¾" x 7¼"

TRANSLOT
FILTER BLOCK

Now Available in BOTH

STANDARD RATE

and

HIGH RATE

Now, Cannelton and Tex-Vit bring you filter block to meet all construction requirements. High Rate and Standard Rate Translot are now available from plants at Cannelton, Ind., and Mineral Wells, Texas, for prompt delivery, anywhere.

Trickling filters constructed with Translot have maximum filtration and maximum aeration—because only Translot gives you three big ducts and five lateral slots in an 11" x 18" block. Translot is longer—2" longer than most—to give you maximum coverage with less handling. Each block is designed to assure absolute resistance to acids, alkalies, and sewage gases—and tested at a compressive strength of 800 lbs. per square inch. *And it's made of chemically inert Vitrified Clay, so it will never disintegrate.*

LIGHT WEIGHT . . .

Makes handling and installation easy. One man can lift and put it in place.

CORROSION RESISTANCE . . .

Translot assures permanence. Unaffected by acids, alkalies, and sewage gases.

GREATER STRENGTH . . .

Translot resists damage when stone is placed. Made of selected Vitrified Clay.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

WELCOME TO THE 1958 MEETING OF THE FEDERATION OF SEWAGE & INDUSTRIAL WASTES ASSOCIATIONS

Sheraton-Cadillac Hotel, Detroit, Mich., October 6-9, 1958

★ ★ ★ ★ ★ ★ ★ ★

TP-958-11

CANNELTON SEWER PIPE COMPANY
CANNELTON, INDIANA

TEX-VIT CLAY PRODUCTS
TEXAS VITRIFIED PIPE COMPANY
MINERAL WELLS, TEXAS
Serving the Great Southwest

WARN HUBS
on your 4-wheel drive stop front end drag in 2-wheel drive!

APPROVED Jeep EQUIPMENT

Models for all makes of 4 w. ds. to 1½ tons at dealers. Write for literature.

NEW ECONOMY! NEW CONVENIENCE!

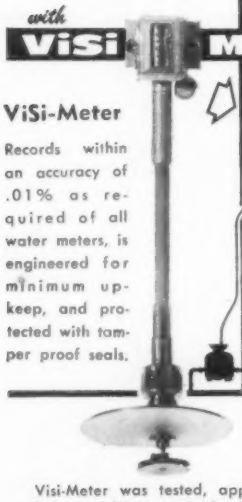
Save on repairs, tires, gas... get new pep, handling ease... with Warn Hubs, the original "selective drive." You'll be way ahead with either automatic LOCK-O-MATICS, or fingertip control Warn Locking Hubs. Unconditionally guaranteed.

PROVEN IN OVER A BILLION MILES OF USE UNDER ALL CONDITIONS!

WARN MANUFACTURING CO., Inc. Riverton Box 6064-P10, Seattle 88, Wash.

Turn Your Meter Reading inside-OUT!

with ViSi METER



ViSi-Meter

Records within an accuracy of .01% as required of all water meters, is engineered for minimum upkeep, and protected with tamper proof seals.

At last a practical remote recording and indicator system now available to cities in quantity. Easily read in one trip by meter readers, Visi-Meter eliminates city's expense and liability of controlling keys to customers' residences. Visi-Meter installations assure existing water meters inside protection.

Home owners like Visi-Meter because no one need enter the home to read water meters.

Visi-Meter was tested, approved and is now being used in quantity by Cincinnati, Ohio, and several other cities.

THIS PRODUCT IS MANUFACTURED AND GUARANTEED BY
ViSi-METER, Inc.
301 NORTH 17th STREET, KANSAS CITY, KANSAS.

TWO PIECE

sliding or screw type cast iron valve boxes for covering 4" thru 10" valves for water or gas. Rugged construction for lifetime service. 5¼" shaft. Extensions as required.

Adjustable VALVE BOXES THREE PIECE

valve boxes supplied with separate bases are available in sliding or screw type. Made with 5¼" and 7" shafts with extensions as required. Complete line of service and roadway boxes.

ALABAMA PIPE CO.

We Invite Inquires to Our Nearest Sales Office
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General Sales Offices
ANNISTON, ALABAMA

APCO

000 to $250,000; 153 between $250,000 and $500,000; and 141 were more than $500,000—53 of these being for a million dollars **or more.**

The 1,150 contracts are the largest number awarded in any year for which there is a record.

Collecting Sewers

Collecting sewer construction awards, not including storm sewers, amounted to $246.6 million. The contracts totalled 2,731, of which 38 were in communities of less than 500 population; 72 in the 500 to 1,000 range; 184 in the 1,000 to 2,500 group; 238 in the 2,500 to 5,000 range; and the remainder fairly well divided in the remaining population groups. About half of the contracts (1,233) were for less than $25,000 each; there were 954 contracts, in the $25,000 to $100,000 group, totalling $52,480,000.

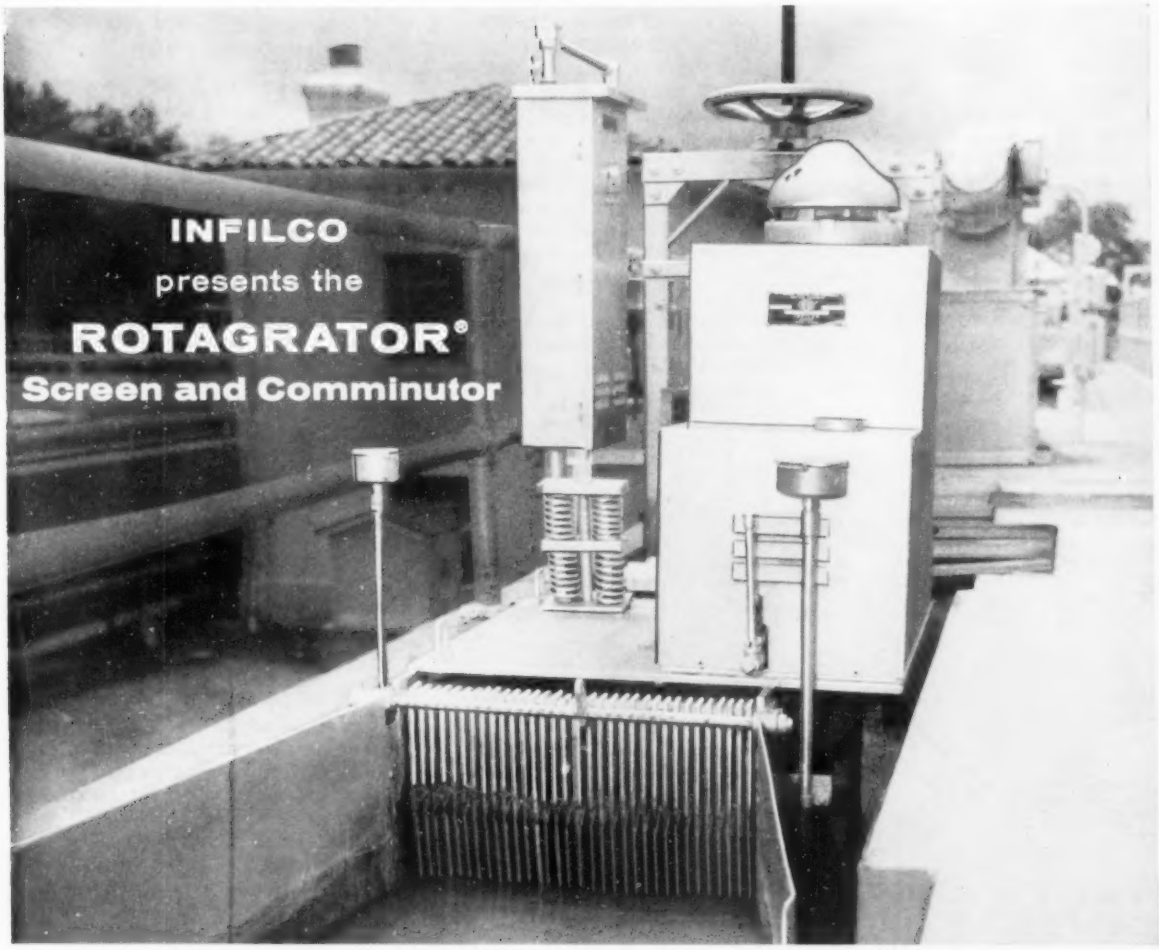
The detail figures given above refer specifically to collecting sewers. Actually, of the $246.6 million awards, $15.7 million represents "combination" projects, that is those covering more than a single field of construction. This expenditure ($15.7 million) is apportioned among sewage treatment, collecting sewers and water works on the basis of past experience.

Almost 75 percent of the volume of contract awards for collecting sewers occurred in locations of less than 250,000 population. There was no single award in excess of $5 million, but there were 21 awards of $1 to $5 million.

Water Works

The data for water works are broken down into the categories of source, treatment, distribution and miscellaneous. Source includes wells, surface supply development and transmission lines. Treatment includes plants and auxiliary facilities. Distribution covers ground and elevated storage and distribution systems. Miscellaneous includes pumping facilities and portions of awards not clearly chargeable to any of the other items and allocated according to past experience.

Contract awards for waterworks construction in 1957, totaled $456.6 million, including the apportioned amounts from combination contracts. Figures hereafter relate only to water works and total $437.9 million, representing 3,535 awarded contracts. The awards for "source" amount to $121,420,000, representing 633 contracts; 195 "treatment" contracts aggregated $79,715,000; 2,180 "distribution" awards amounted to $156,706,000; and 527 "miscella-

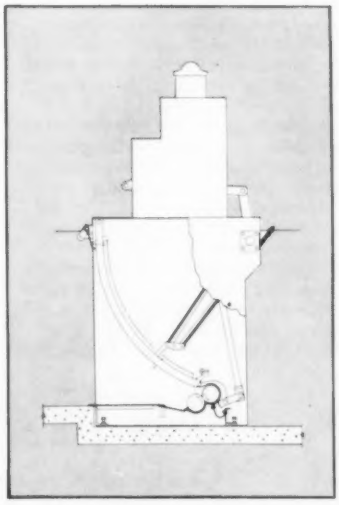


. . . for faster, more complete COMMINUTION OF SEWAGE SOLIDS!

Proved in field operations, this improved screen and comminutor will out-perform and outlast any other equipment of its type on the market.

Most materials are handled in a single pass. Rollers at the bottom of a curved bar screen intercept heavy solids—lighter ones are raked down automatically. Any over-size comminuted solids are automatically rescreened and returned to the comminuting rollers until reduced to a size that permits passage through the screen.

No matter what the load may be, the unit operates continuously without harm to the mechanism, because of its rugged construction and safety devices incorporated in its design.



The "ROTAGRATOR" screen and comminutor is a completely packaged unit ready for simple and easy installation. A full range of sizes is available. For complete information write today for Bulletin 5150-A.

INFILCO

Over 60 years of engineering leadership in water, sewage and waste treating equipment.

Infilco Inc.
General Offices: Tucson, Arizona
P.O. Box 5033

Field offices throughout the United States and in foreign countries.

The ONLY Company IMPARTIALLY offering equipment for ALL types of water and waste processing—coagulation precipitation, sedimentation, flotation, filtration, ion exchange and biological treatment.

58-

neous" represented a total of $80,-055,000.

Of the awards, 261 were for communities under 500 population with a total of $9,653,000. Of these 60 were for source, 11 for treatment, 147 for distribution and 43 for miscellaneous. There were 257 awards in the 500 to 1,000 population bracket, with very nearly the same money value and distribution as for the less than 500 communities. The 1,000-2,500 group had 442 contract awards totalling $21,976,-000—63 for source, 33 for treatment, 269 for distribution and 77 for miscellaneous. There were 359 awards in the 2,500-5,000 area, 357 in the 5,000-10,000 cities and 538 in the 10,000 to 25,000 range. There were 1144 awards in larger places.

Of the contract awards, 68 were larger than a million dollars; 1539 were less than $25,000; and 1,245 were between $25,000 and $100,000. Awards for treatment included 72 under $50,000. Contracts for treatment included 56 places under 2,500 population.

These data, and those for the five years previous, have been transferred to punched cards for ready processing to permit detailed summarization and analysis.

Did you hear a lot of customer complaints about low water pressure last summer? After the spring's heavy rains which filled reservoirs to the brim all over the country, *there should be no water shortage.* The problem probably rests underground . . . mains and distribution grids choked by pressure-killing tuberculation and corrosion.

There's one sure cure for your pressure problem . . . the Centriline Process. Centrilining permanently increases carrying capacities in all sizes of pipe by eliminating tuberculation and corrosion forever. After loose scale and tubercules are removed from the pipe, the Centriline machine applies a smooth, uniform coating of cement-mortar to the pipe wall by centrifugal force. Fast and economical, Centrilining is accomplished with a minimum of interruption to surface traffic, since the pipes are lined in place and excavations are not required at laterals and services.

With the introduction this year of the new, small diameter Centriline machine, you can permanently protect all water lines from 4 to 144 inches in diameter. Send today for our new brochure which fully describes the Centriline Process.

CENTRILINE CORPORATION

A Subsidiary of Raymond International Inc.

140 Cedar Street
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Branch Offices in Principal Cities of the United States, Canada and Latin America.

Sales Promotion, PR and Advertising Man Available

A man experienced in sales promotion, advertising, public relations, editing, photography and convention and exhibit participation is available. He is 35 years old, married, 3 children, BS degree, wide experience in above fields. Prefers location in East. Write Box W-10, Public Works, 200 South Broad St., Ridgewood, N.J.

Engineer Wanted

A firm manufacturing equipment for sewage treatment needs a sanitary engineer who is interested in learning how to sell and to provide technical service through field representatives. Location in the East-Northeast. Excellent opportunity. Moderate travel will be involved. Write to Box T-10, Public Works Magazine, 200 South Broad St., Ridgewood, N. J.

Assistant Director of Sanitation Needed

Due to expansion of the sanitary engineering program in Maricopa Co., Arizona, an assistant is needed for the work which is under the general direction of Joseph Weinstein. There is an opportunity for good experience in technical and administrative duties and responsibilities. Pay is $6234 to $7692. Write the Arizona Merit System, 11 North 17th Ave., Phoenix, Arizona, giving full personal information.

• • •

Standards for Clay Pipe

The Department of Commerce, Community Standards Division, has issued a recommended "Commercial Standard for Vitrified Clay Sewer Pipe," designated TS-5414; and a recommended revision of CS143-47, "Standard Strength and Extra Strength Perforated Clay Pipe," designated TS-5413. Limited copies are available from the Division Office in Washington.

Cincinnati's Metropolitan Sewage Disposal System

The Mill Creek Sewage Works of the Cincinnati Metropolitan System will be dedicated on June 18, 1959. A program for the event has been issued by Arthur Caster, Principal Sewage Disposal Engineer. The Ohio Sewage & Industrial Wastes Treatment Conference, which will meet in Cincinnati on June 17, 18 and 19, will participate in the dedication.

No interruptions in service when you install

WOOD GATE VALVES

Because of their inaccessibility underground, repairs to gate valves are always time-consuming, expensive, and a source of annoyance. And interruptions in service while repairs go on are hazardous for the community.

For these reasons, R. D. Wood Gate Valves are designed to function for generations no matter what the conditions. They are rugged in construction, fully bronze mounted, and tested to 300 lb. hydrostatic pressure. Designed for working pressures conforming to AWWA specifications.

Available with mechanical joint or flange-type pipe connection

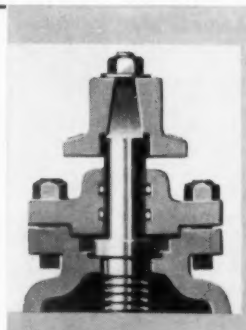
SIMPLE IN DESIGN

Only three moving parts—a spreader and two discs which are free to revolve their complete circumference while being raised or lowered. Gates are lifted clear of valve seats, providing unobstructed flow.

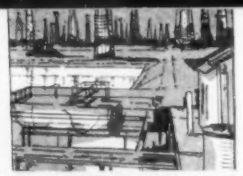
R. D. WOOD COMPANY

Public Ledger Building, Independence Square, Philadelphia 5, Pa.

Manufacturers of Mathews Hydrants and "Sand-Spun" Pipe (centrifugally cast in sand molds)



R. D. Wood Gate Valves also available with O-Ring Stuffing Box seal when specified.



PUBLIC WORKS DIGESTS

Prepared by
CLAYTON H. BILLINGS
Associate Editor

THE INDUSTRIAL WASTE DIGEST

Improved COD Test Procedure

The application of chemical oxygen demand tests for quick determinations of the state of oxidation of wastes was given impetus by the development of the dichromate reflux procedure in 1949. While this yielded a high degree of oxidation of some compounds, it was ineffective with organic aliphatic acids and numerous other compounds. The procedure was further improved in 1951 by using a silver catalyst, but the presence of chlorides caused low and unpredictable results. A study of the dichromate reflux procedures showed that inorganic chlorides are oxidized to free chlorine by dichromate-sulfuric acid in the absence of silver sulfate, and the chlorides are removed by the reflux procedure. A method was then devised to compensate for chlorides present in the sample by initial oxidation of the sample with standard dichromate in the absence of the catalyst. Through this procedure the catalyst can be added later to complete the determination, thereby effecting a higher degree of oxidation than before the chloride correction was applied. The chlorides may then be independently determined and the gross COD adjusted by subtracting a correction. The modified dichromate catalytic reflex method is of value in determining the COD of petrochemical wastes, since appreciable quantities of chlorides are often present.

"Chemical Oxygen Demand of Petrochemical Wastes." By F. W. Bertram, O. T. Carlisle, J. E. Murray, G W. Warren and C. H. Connell. *Analytical Chemistry*, August, 1958.

Textile Waste Treatment Research

Three phases of the textile waste disposal research at Cone Mills laboratory are discussed: the various characteristics and pollutional effects from cotton processing, some of the more practical treatment methods, and the effect of outside factors on biological treatment. It was concluded that the amount of textile waste that can be treated without pretreatment is limited by the amount of hydroxide alkalinity rather than by the pH of the mixed waste. Biological processes are not affected by various concentrations of potassium ferrocyanide, but are by cyanides and chromium. Temperature and recirculation rates affect trickling filter results; however, recirculation rate increases lower the concentration of BOD in the effluent without affecting percent removal. Lagooning reduces BOD, hydroxide alkalinity, and total settleable solids. Seeding mixed textile waste before lagooning might be used to diminish storage time as well as effect improvement in effluents.

"Current Research on Textile Waste Treatment." By R. H. Souther and T. A. Alspaugh. *Sewage and Industrial Wastes*, August, 1958.

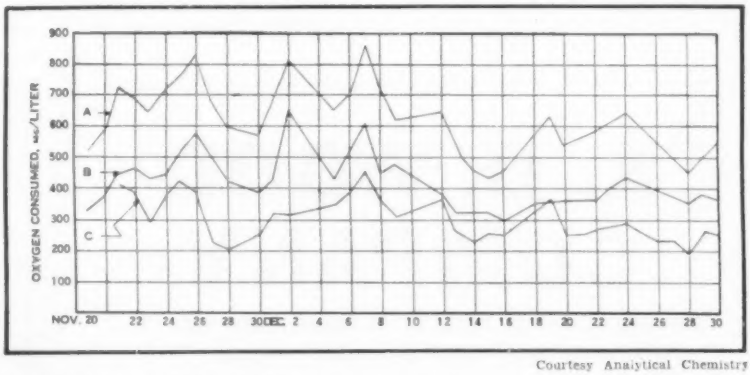
Spray Disposal of Solids with Liquids

With the objective of improving the handling of solids from most canning operations, a study was undertaken to determine the feasibility of including comminuted solids in wastes discharged to land areas by spray irrigation. The plant process waste was passed through a large rotary screen, and the separated solids were fed through a comminutor back into the waste streams. Comparisons were made between areas sprayed with comminuted solids and those with liquid only. Since the scope of the study with respect to waste variety was limited, generalized observations could not be made on the application of comminuted solids of all wastes. With regard to pea canning wastes, the method is feasible if some mechanical problems could be overcome, and the cost of operation is less than with seperate disposal of solids. There appeared to be no evidence of deleterious accumulation of solids on the land areas, nor any effect on the permissible application rate. Substantial nutritional effects can be contributed to the soil by the practice through the addition of basic nutrients and humus.

"Comminuted Solids Inclusion with Spray Irrigated Canning Waste." By R. A. Canham. *Sewage and Industrial Wastes*, August, 1958.

Radium in Waste Discharges

In American uranium ores, U^{238} is present to the extent of about 99.28 percent and is the parent of a long series of radioactive elements found in nature. Among these is radium, a bone-seeking alpha emitter with a half-life of 1,620 years. Only uranium is recovered from the ore, and all remaining members of the series are included in the process wastes. It is estimated that around 2500 grams of radium ^{226} are discarded per year. The presence of radium in soluble form causes the most concern and is the target of limit standards. The solubility is



Courtesy Analytical Chemistry

● **CURVES show COD and BOD of plant waste water stream. Curve A is the modified dichromate catalytic reflex; B is dichromate standard reflex; and C is 5-day BOD.**

Clay Pipe solves infiltration in wet trenches

DESPITE extremely wet trench conditions, installation of a new sanitary sewer system at Beach Haven, New Jersey, was completed in record time with Vitrified Clay Pipe. More than 29,000 feet of Clay Pipe in 6, 8, 18, and 21 inch diameters were installed, yet the standard Weir test showed an infiltration rate far below specified requirements.

Easy installation and infiltration resistance are but two of the important features offered by Vitrified Clay Pipe. No substitute pipe can match its many advantages. Chemically-inert, it is completely resistant to the corrosive action of all sewerage gases and resulting acids. Its smooth, hard inner surface and new longer lengths insure smoother, faster flow so that the line handles its rated capacity continuously.

Vitrified Clay Pipe is the only pipe backed by a long-term written guarantee—your assurance of corrosion-proof service long after the last bond has been retired.

When you plan and install new sewerage facilities, don't be misled by the two or three advantages claimed by substitute pipe. Get all the advantages of longer, denser Vitrified Clay Pipe, with its tighter, time-saving, research-developed joints.

Engineer: William H. Boardman
Contractors: Canning & Cestone, Maplewood, N.J.

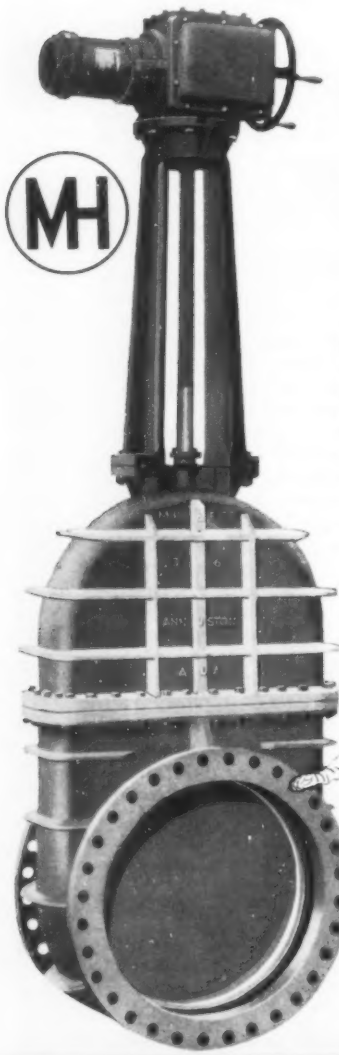
C 958-1

Vitrified **CLAY PIPE** *Never Wears Out*

NATIONAL CLAY PIPE MANUFACTURERS, INC. 1820 N Street, N. W., Washington 6, D. C.
311 High Long Bldg., 5 E. Long St., Columbus 15, Ohio • 703 Ninth & Hill Bldg., Los Angeles 15, California • Box 172, Barrington, Illinois • 206 Mark Bldg., Atlanta 3, Georgia

dependent on the initial form of radium in the ore and chemical changes taking place in ore processing. In most cases it is largely insoluble. Wastes from processing are generally discharged to tailings ponds where the liquid volume is reduced by seepage and evaporation. In response to requests from several state health departments, the Public Health Service carried out a field study of surface water contamination resulting from uranium refining operations in the Colorado Plateau area in 1955 and 1956. Gross alpha and beta activities of water, muds and biological material were determined. While no water supplies in the area appeared endangered, the dispersion of radium throughout silt and biota as well as water carry other implications, such as the present usefulness of the streams for irrigation and farm use and the damage done from the standpoint of future use. The long half-life of radium indicates that the problem should be approached with considerable caution.

"Effects of Uranium Ore Refinery Wastes on Receiving Waters." By E. C. Tsivoglou, A. F. Bartsh, D. E. Rushing, and D. A Holaday. *Sewage and Industrial Wastes*, August, 1958.



Motor Operation

FOR BIG VALVES

Remote operation and control of valves by electric motors is not only a great convenience but frequently increases efficiency and reduces operating costs. Electric motor operation is recommended for valves which are frequently operated or valves which are located in remote or inaccessible or hazardous places. (If preferred, M & H cylinder operated valves may be used for similar service.)

All types of M & H Gate Valves are available with electric motors installed on the operating mechanism. They are standard M & H valve design and construction, i. e., iron body, bronze mounted, double disc, parallel seat, or solid wedge as desired. Illustrated at the left is a low pressure 36-inch motor-operated M & H Valve. For detailed information, *write or telephone* . .

M&H VALVE AND FITTINGS COMPANY

ANNISTON, ALABAMA

SUBSIDIARY OF WALWORTH

Efficient Communications for Northern Illinois Toll Road

When the new Northern Illinois Toll Road is opened for use later this year the motoring public will be protected by a microwave two-way voice communication and signaling system. RCA Telecommunication Division is contractor for the facilities and has designed a complete communications network, comprised of 22 stations completely independent of any existing public systems.

An integral part of this communication system is multiplex equipment furnished by Stromberg-Carlson. This equipment—the 511 Multiplex—provides maximum flexibility in application to both voice frequency and tone signaling requirements, transmitting any desired combination of signals such as telephone, teletype and facsimile directly by point-to-point radio. The units employ frequency division, single sideband, suppressed carrier techniques, for economical use of available frequencies. The basic group of 10 channels, occupying the 4 KC to 44 KC portion of the frequency spectrum, may be expanded through the use of translators to any number of channels up to 170 within a minimum baseband requirement of 900 KC.

• • •

Work Shirts Color Coded for Safety

A system using different colored shirts to identify the various professions on construction sites has been reported by the Vat Dye Institute and Esso Oilways. By employing cotton shirts or jackets, the Institute has developed a coding system that not only immediately identifies the particular skill of the worker wearing the garment but also indicates the relative dangers of the job he is performing. The colored shirts also permit a quick visual check on manpower distribution.

The identifying color for each trade may be varied for different types of construction but a typical system would have electricians wearing blue, steel workers red, bricklayers yellow and laborers brown.

Additional safety is provided with this system by preventing a worker from being assigned to a relatively hazardous job for which he is not qualified. This sometimes happens during the rush of daily activity on a construction site when personnel identification by supervisor is difficult.

New Vistas

DURING this past year we have continued to manufacture and place in operation Coilfilter installations at the same heavy pace as for the previous 4 years.

As in 1957 a large percentage of this work is repeat order business; Consulting Engineers who have used our equipment have come to realize the performance that is built into the Coilfilter design and the high caliber of service rendered by our field crews.

As far as research is concerned most of this has been of a practical nature in inquiring further into the possible advantages, and drawbacks, of fresh solids dewatering. Actual operating experience in the field has been very good and the question of pathogenicity has been largely resolved. Material on this phase of our work will be reported in Technical Publications and promises to be the next big advance in the practice of Sanitary Engineering.

We are pleased to know that the auxiliary equipment developed by us through the years, involving mainly the chemical feeders and sludge pumps, is operating with complete satisfaction in numerous installations. This phase of our activity has generated more confidence among Engineers in mechanical sludge dewatering.

Again we wish to express our appreciation to the Sanitary Field for the work we have been permitted to do during this most successful year.

As far as the future is concerned, it would appear that there is plenty of work for those who lead.

Respectfully,
T. R. Komline

KOMLINE-SANDERSON
ENGINEERING CORPORATION
MANUFACTURERS OF THE COILFILTER
PEAPACK, NEW JERSEY

UNIQUE DESIGN
Solves
STORM WATER PROBLEM

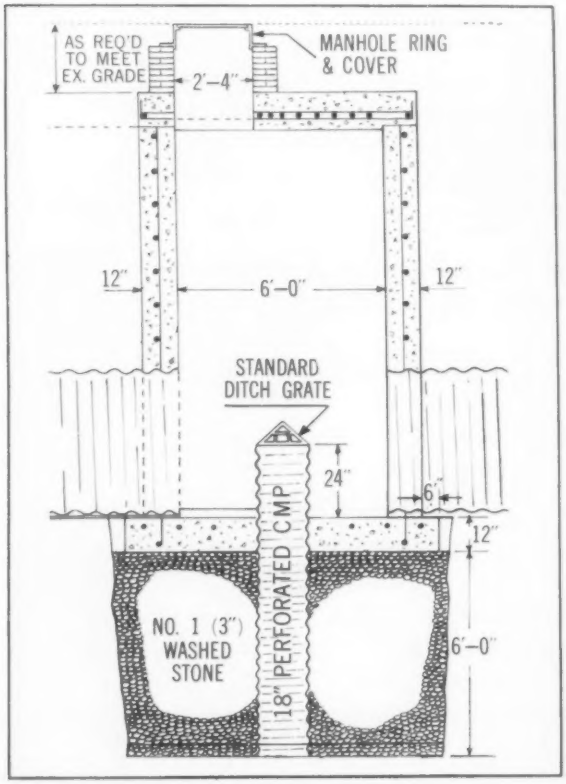
FRED E. HARDY,
Director of Public Works,
Zanesville, Ohio

formerly City Engineer
Hamilton, Ohio

ABOUT a square mile of new subdivision in the South Lindenwald area of Hamilton, Ohio, was developed between 1946 and 1957 without a main outfall storm sewer. In some streets the usual type of storm sewers were provided with the outfalls terminating in an open pit sump. Other streets had some form of underdrainage but some were not provided with any storm sewer facilities.

The subdividers took advantage of the underground soil conditions in the area (which were sand and heavy gravel deposits several hundred feet deep) to allow the storm water runoff to seep to the underground strata. The ground water level is about 80 feet below ground surface. The open sump constructed to provide an outfall for some of these storm sewers was about 60 feet square and 10 feet deep. It was located on two privately owned lots under a five-year lease expiring in December 1956. The owner of the two lots wanted the open sump pit removed.

Because of the concentration of storm runoff into the sump without regard to the absorptive qualities of the ground, this particular pit had been the source of trouble and damage claims due to over-flows onto adjacent industrial property. With residential structures being built closer, it was becoming a source of danger to children living in the area.



● **SPECIAL junction structure was designed to facilitate cleaning and to provide for dispersal of storm water flows.**

● **VERTICAL pipe is elevated and covered with a special grate to prevent clogging of underground porous materials.**

This is the
HYDRO
E-Z PACK
It's a packer body designed to bring a new kind of efficiency and economy to trash and garbage disposal.

Hydro E-Z Pack customers wrote this advertisement!

J. Ted Tharp, Mt. Vernon Garbage Co., Mt. Vernon, Ohio
"We service about 1800 homes and several commercial accounts with three men in a 30-hour week. We particularly like the fast-opening back door and the fins in the top. Our next body will be an E-Z Pack."

C. Elmer Coulter, Peoria Disposal Co., Peoria, Illinois
"Just completed a cost analysis on our five Hydro E-Z Pack units compared to other packer-type bodies. On one account for 31-day period, savings were: 34 loads vs. former 102 loads; labor $136; mileage 1360 miles; gasoline 240 gallons; oil 5 quarts. After allowances for truck and tire wear, we came up with actual monthly savings of $227.20 on this one account. We figure one E-Z Pack replaces three other-type units."

H. W. Johnson, City Manager, DeLand, Florida
"Watertight body eliminated all complaints due to loss of fluid from garbage. We haul in one E-Z Pack load what formerly required seven large open truck loads."

Stanley J. Twardus, Newark, Delaware
"I intend to buy another E-Z Pack in the near future because the company stands behind the product. I have two now."

Russell Snow, V.P., Refuse Service, Inc., Battle Creek, Mich.
"It packs garbage well, is well constructed, has a pleasing appearance and side-loading feature is less hazardous to our employees."

Philip Lehl, Jr., Portland, Oregon
"Like it very much . . . not a thing it won't handle. No maintenance expense either."

C. J. McElligott, Asst. Mgr., Oco Waste Paper Co., Cleveland, Ohio
"It handles with ease what we formerly loaded into a 32′ van body. One E-Z Pack load equals four 14′ stake body loads. In reducing bulk, it has no competitor."

Adam Schleining, Santa Ana Commercial Co., Santa Ana, Calif.
"Absolutely no maintenance problems of lost time while operating 17 E-Z Pack units in three cities. One man picks up 350-400 stops per day, makes fewer trips to dump."

Hydro E-Z PACK

WHAT MORE CAN WE SAY?

. . . except that Hydro E-Z Pack, the modern disposal method, can do all these things for you, too. Write today for full details.

HYDRO E-Z PACK

EZ-658

HYDRO E-Z PACK DIVISION–HERCULES GALION PRODUCTS, INC., GALION, OHIO

The Bureau of Engineering of the City designed a storm sewer system for a subdivision in an adjacent area, but this was not constructed since the property owners rejected the entire street improvement program for the subdivision because of cost and other reasons.

Even so, the design contained several useful ideas. The proposed storm system utilized specially perforated and fully coated corrugated metal sewer pipe to handle the storm water runoff. The perforated pipe was to be laid on a bed of coarse aggregate (maximum 2-inch size), which would be carried up to the mid-point of the pipe. In place of the usual manholes, "junction structures" were designed to permit cleaning of the connecting sewers; also to provide separate points of dispersal of storm water that did not seep out of the perforated pipe into the porous formation before reaching the junction structures. This design permitted much of the storm water to pass into the underground sand and gravel without exceeding the absorptive capacity of the soil at any point.

Since the open pit sump near Hammond Boulevard and St. Clair Avenue intersection was near the end of the proposed large storm sewer, the Bureau of Engineering suggested that this should be eliminated and the new storm sewer begin there. This would permit a start on the new storm sewer; the improvement would be permanent; the open pit would be eliminated; no construction on private property would be involved; and the proposed section of storm sewer would cost no more than a proposed larger new open pit and the required connecting storm sewer.

This proposal of the Bureau of Engineering was adopted and the project was designed by the city engineer. Approximately 654 feet of Armco fully coated corrugated metal sewer pipe, 48-inch diameter, was used for the main sewer. The pipe was specially perforated in the bottom half.

Junction Structures

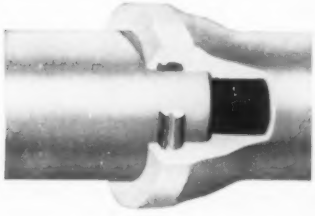
The junction structures provided the separated dispersal areas for the storm water runoff. Underneath the base slab a 6-foot deep area of the same dimensions as the base slab was filled with coarse aggregate. In the center of the area, before placing the aggregate, a section of 18-inch diameter corrugated metal pipe was set upright. This pipe is perforated around its circumference and extends from the bottom of the excavated area to a point 18 to 24 inches above the finished surface of the base slab of the junction structure. After the pipe and gravel were in place, the top of the gravel was covered with roofing paper and the base slab poured; then the junction structure was completed.

A cast iron grate casting was fitted to the top of the vertical drain pipe extending above the base slab to prevent debris, mud and silt from entering and clogging the subsoil strata and reducing its absorptive qualities. The concrete base slab permits the street department to clean the floor of the junction structure of accumulations of mud and debris without disturbing the underground absorption area.

The use of the specially perforated corrugated metal sewer pipe in the main sewer on a 12-inch bed of coarse aggregate is a reverse of the principal use of perforated pipe, namely to drain underground water away to a proper outfall. However, it has met the designer's expectations and proved the theory on which it was based. It has been adopted as standard construction for storm sewers in this particular area, replacing other types of underground systems formerly used.

BIGGEST IMPROVEMENT

IN PIPE JOINTS IN GENERATIONS



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No bell holes needed, no bolts, no glands, no wrenches, no lead pot, no calking tools. The only joint accessory is the Tyton* Gasket. Unskilled workmen can insert the gasket into the bell and then push two pipes together. Photo shows use of a jack to force the plain end into the Tyton bell on sizes 10" and larger. On sizes 8" and smaller the two pipe may be joined with a fork tool or with a crowbar. The jack or the fork tool are furnished with the pipe on a loan or purchase basis.

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(2" and 2¼" Through 12" For Water Mains)

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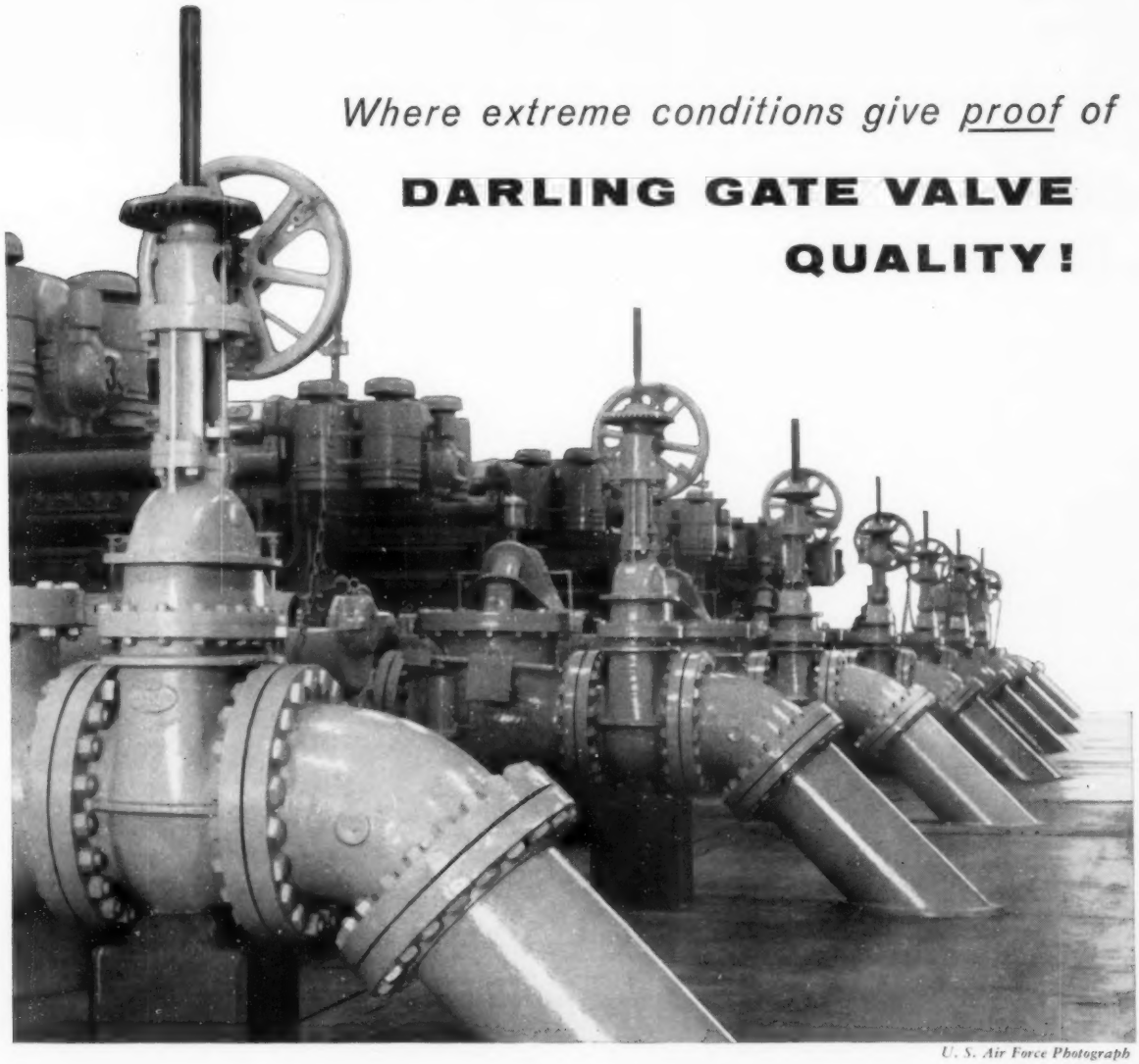
DARLING GATE VALVE QUALITY!



U. S. Air Force Photograph

From zero to 30,000 gpm demand...suddenly!

Fast pressure changes and heavy line surges are the rule in this system supplying water to the rocket launching pads at a large Air Force test center. The Darling valves installed here must take this severe service in stride . . . and still continue indefinitely to provide smooth, positive response!

There are a number of Darling valve features that assure such performance—features that can help avoid trouble and maintenance in your service, too! For example there's the automatic seating compensation, uniform wear distribution and drop-tight closure assured by Darling's unique gate principle with its fully revolving double discs and parallel seats. You are certainly welcome to complete data on Darling gate valve features, sizes and types. Get *all* the facts! Send for Bulletin 5710.

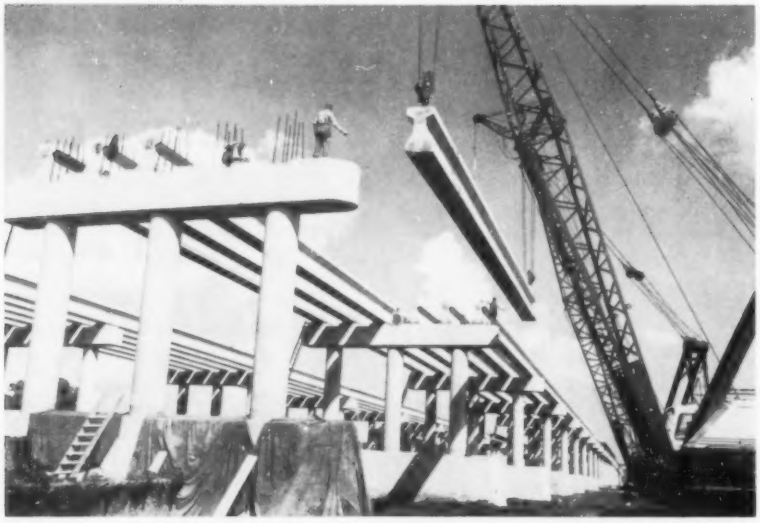
DARLING VALVE & MANUFACTURING CO.

Williamsport 22, Pa.

Manufactured in Canada by The Canada Valve & Hydrant Co., Ltd., Brantford, Ontario

DARLING TRADE MARK VALVES

Prestressed Concrete Girders for Longest Structure on Illinois Toll Highway



A TOTAL of 456 prestressed concrete girders will be used to build the 4,940-ft. bridge which will cross the Chicago Sanitary and Ship Canal, the Illinois and Michigan Canal, and the GM&O and Santa Fe Railroads just south of LaGrange, Illinois, on the Illinois State Toll Highway.

Span length of each girder is 88 ft. 10¾ ins. and each girder's weight is approximately 45 tons. The bridge consists of two parallel separated lanes.

The girders are being manufactured by the American-Marietta Co. at its Hodgkins, Illinois, plant, and are delivered ready for installation at the site of the bridge's construction.

George L. Jackson, chief engineer of the Illinois Toll Highway Commission, points out three primary reasons for the selection of prestressed concrete girders for this construction: 1) Lower costs; 2) quicker completion; and 3) expected lower maintenance expenses. Engineers found that they could save an average of $20,000 on each of 200 bridges by using precast concrete deck spans.

• • •

Highway Lettings in Montana

The Montana Highway Commission awarded an all-time high in contracts for one month in July, 1958, when a total of $8,135,110 in road contracts was awarded. In the four previous lettings in 1958, contracts amounting to $14,604,942 have been awarded, bringing the total so far this year to $22,740,052. This amount surpasses all awards during the entire year in 1957, and is rapidly approaching the previous annual high of slightly more than $25 million set in 1956.

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- 7—Low operating cost
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- 9—Less "time out" washing filters

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Filters are in service more as wash water cycle shorter. Better removal of bacteria, taste, odor. Increased Filter output, better effluent. Ideal for industrial acid and Alkaline solutions. Ask any user.

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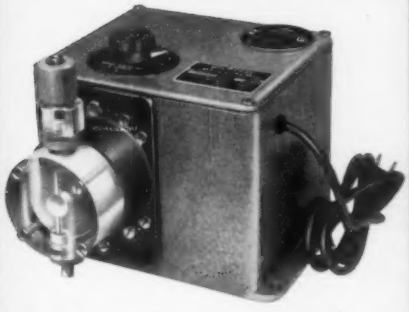
Models are engineered for automatic proportioning systems. Every pump is covered by a one year guarantee.

For further information, write Department 3A, Precision Chemical Pump Corporation, 1396 Main Street, Waltham 54, Massachusetts.



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pH control • corrosion control
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PRECISION CHEMICAL PUMP CORPORATION
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Two Years of the Federal Water Pollution Control Act

NOW that the Federal Water Pollution Control Act has been in effect two years, the Editors of PUBLIC WORKS have felt it desirable to summarize the scope of the program and its accomplishments. Essentially the program provides for: Construction grants to municipalities; provisions for interstate enforcement procedures; grants to state and interstate agencies for support of their pollution control programs; collection and evaluation of basic data; research; and training and technical assistance to make research findings useful to State and local agencies and industry officials.

Construction Grants

As of July 31, 1958, 1,082 municipalities had received offers of Federal grants totalling $89 million; the total estimated cost of these projects was $458 million. This shows that each dollar of Federal aid was matched by $4 of local funds. Of the 1,082 projects, 172 have been completed (as of July 31) and 545 were under construction. The remainder were in various stages of final plan preparations, financing and/or advertising.

Applications have also been received for an additional $99 million grants from 1,020 communities. Plans and specifications are being prepared or applications on these are being processed.

As indicating the beneficial results of the program, sewage treatment plant construction in the calendar year 1957 exceeded the 1952-56 average by 40 percent; and for the fiscal year 1958 is expected to be considerably over the 1952-56 average; but the estimated needed annual expenditure of $500 to $600 million for sewage treatment has not yet been reached.

Of the projects approved, 80 percent involve construction of new sewage treatment works. In 582 communities, this construction represented the first sewage treatment they ever had; in 245 others inadequate facilities were completely replaced. The other 255 projects provide for plant enlargements and other improvements.

The average population served is 10,000; 96 percent of the grants went to communities of less than 125,000 population. An especial benefit to many small communities is the fact that the grants permitted construction of a sewer system, not possible without treatment for the collected sewage.

Interstate Pollution

Public Law 660 provided procedures for solution of interstate pollution problems beyond the power of a single state to solve. The initial step is a conference of state and interstate officials called by the Surgeon General of the Public Health Service. Since passage of the act, eight such conferences have been held, resulting in agreements on specific methods and time schedules for the construction of waste treatment facilities estimated to cost $457 million. These, when completed, will result in improvement of 1269 miles of streams.

Under this section, background information is being compiled on more than 150 miles of actual or potential interstate water pollution problem areas; and two of these problem areas have conferences scheduled for this fall.

Control Program Grants

To assist State and interstate water pollution control agencies in extending and improving their programs, Congress has appropriated a total of $8 million. The states and other agencies are using these funds in a variety of ways, principally for employment of additional technical and scientific personnel and for purchase of laboratory and field equipment. In some cases, the grant funds have afforded an opportunity to resume previously interrupted surveys and studies; in other cases, improved information activities and consultative services to municipalities are emphasized. Several agencies have initiated research work for the first time; still others are placing increased emphasis on enforcement activities within their respective States. For example, in Wisconsin, a Federal program grant has made it possible to employ additional engineers, a biologist, and a full-time attorney along with additional clerical personnel. This will make possible increased enforcement activity. The Federal grant has also made possible the establishment of a research contract with the University of Wisconsin to determine the effect of pollutants on the flavor of fish, which program is now in progress.

Collecting Basic Data

Accurate current information on water quality, use and needs is essential. Basic data on water quality is collected from a nationwide network of 50 sampling stations which have been activated during the past

● **DISTRIBUTION of Basic Data Stations established during Fiscal Year 1958 as part of the water quality network is shown by black dots on the map above. Numbers on each State indicate Federally-aided Construction Grants Projects through Fiscal Year 1958. In addition, there were 2 projects for Hawaii and 11 for Puerto Rico.**

New DEMPSTER-DINOSAUR Ends LONG-HAUL Problems

Slash Costs! Get More Than 40 YARDS Per Trip With These Giant "PORTABLE DUMPS"

Up to 40 cubic yards and over . . . up to 30,000 pound loads . . . plus the advantages and economies of detachable containers . . . that's the story behind the all-new DEMPSTER-DINOSAUR. The safe, foolproof DINOSAUR is a masterpiece of simplicity . . . three simple, piston-type cylinders do the work . . . no cables to attach . . . no sheaves . . . no telescopic cylinders . . . maintenance and operational costs are slashed to the bone! It's the only machine of its type that picks up containers without the driver leaving his cab. The only one that can put containers on a dock.

Big-capacity DEMPSTER-DINOSAUR Containers are "Portable Dumps" can be used as transfer stations for DEMPSTER-DUMPSTER LFW and GRD installations or conventional trucks. They also provide adequate storage for big-accumulation points such as schools, hospitals, institutions and industrial plants.

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eighteen months. These supplement data obtained on a cooperative basis with a number of collecting points by cities and industries. Information other than water quality is presently gathered from construction grants projects, and inventories of water supply, sewerage and industrial waste facilities.

A nationwide network of 50 water quality sampling stations has been established by the Public Health Service through the cooperative efforts of State and local agencies, universities and industry. These stations, with others planned, will furnish continuous information on the nature and extent of pollution affecting water quality at these particular points. They will provide baselines for measurement of improvement and for early detection of water quality deterioration. In addition to their usefulness in guiding and evaluating pollution control programs, these data will be useful in selection of sites for municipal and industrial use and for many other purposes.

Collection and analysis of the water samples is being conducted by the Robert A. Taft Sanitary Engineering Center with the active cooperation of State and local agencies. The first publication of data developed in this cooperative program is expected to follow shortly after the end of the "water year," October 1, 1958.

The detailed information on the grant-aided projects provides an opportunity for studies of plant design, conceptions of cost relating to financing, engineering and supervision, construction and operation and maintenance. Such studies are being conducted on a continuing basis and are expected to produce baseline data which will be useful for planning purposes.

Collection and publication of inventories of water supply, sewerage and industrial waste facilities is a part of the basic data program. The "Inventory of Water Supplies in Communities of 25,000 and Over" (as of December 31, 1956) has been published and distributed. A similar inventory for 1957 is on the press. These data will be combined with data on water supply facilities for communities of under 25,000 and published as the "1958 Inventory of Water Supply Facilities in the United States." The "1957 Inventory of Municipal and Industrial Waste Facilities" is also in press and scheduled for release in early fall.

The data used to compile these specific inventories are documented by mechanical recording devices and filed for ready use in the basic data section of the Public Health Service. Through this machine-card type system, specific data requested on any river basin can be quickly supplied.

An example of how the basic data program can be utilized is illustrated by the request from a group responsible for damage assessment of atomic disaster areas for detailed information concerning water supplies in cities of over 25,000 population. This information was used to determine the extent of water supply destruction and remaining capacity in the event of atomic disaster.

Another area of study is the application of economic analysis to water pollution control. A search is under way for techniques to determine what pollution is costing and what expenditures for controlling it can be economically justified.

Inventories submitted by the States show that, of the national population of 173 million, 98 million are served by sewers. Of these, 46 million have 4,700 adequate sewage treatment facilities; 30 million have 2,800 inadequate facilities; and the remaining 22 million are in

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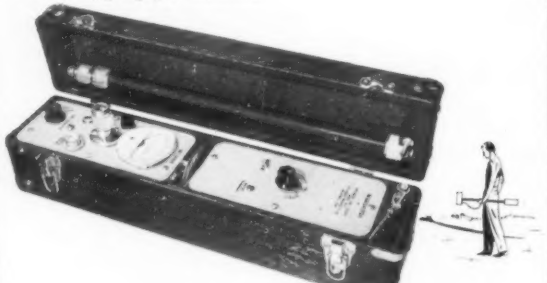
THE NEW MINIATURIZED WILKINSON LINE LOCATOR MODEL W-3

This radically new, powerful, transistorized locating instrument weighs only 4 pounds and is ¼ as large as old type pipe locators.



It's as handy as a flash light. The transistors rarely require replacement; non-leak mercury cells outlast old type batteries at least ten times. The instrument cases are molded glass fibre. The aluminum connecting handle telescopes to 17 inches, and the entire instrument comes in a substantial carrying case.

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need of 3000 new sewage treatment works.

Data supported by information from State water pollution control agencies indicate that to meet domestic sewage treatment needs by 1965, cities must spend $500 to $600 million per year. Stated in different terms, the annual cost per capita of sewered population is between $5 and $6 taking into consideration expected obsolescence and population growth during this period.

Progress in water pollution control is at a higher level now than ever before. While the Federal program has stimulated construction of sewage treatment plants, has helped to solve interstate water pollution problems and has provided for research, progress to date must be accredited to the States, municipalities and consultants as well as the Public Health Service.

• • •

County Road Department Administrative Center

Ground has been broken and construction is under way on a new $3,159,000 County of Los Angeles Road Department Administrative Center, according to Twaits-Wittenberg Co., constructors and engineers. Principal architects for the 163,000 sq. ft. project are Walker, Kalionzes and Klingerman; Lunden & Associates are associate architects.

Facilities at the Center will consist of a modern two-story administration building and a central yard office building. The Road Department is scheduled to occupy the new facilities late in 1959. Road Commissioner Sam Kennedy reports that at present, the Department maintains 4200 miles of roads and 450 bridges in the county. It also maintains an additional 1000 miles of roads under contract with various cities in the county.

More than 500 engineering, administrative and clerical employees, who comprise the various divisions of the Department, will be housed at the new Center.

• • •

Municipal Airports in Minnesota

There are 97 municipal airports in Minnesota, 31 of which have paved runways. There are also 21 public-use airports which are privately owned, 302 air strips privately-owned for private use, and 18 seaplane bases. At the municipal airports with surfaced runways, the largest expense items are seal-coating of runways, snow plowing and building of hangars to make the fields usable on a year-around basis.

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PNEUMATIC SEWAGE EJECTORS

• RUGGED
• DEPENDABLE
• ECONOMICAL

A K-S pneumatic sewage ejector system offers trouble-free service at the absolute minimum of maintenance and power costs.

Available in sizes from 30 to 600 GPM capacities, in single or duplex units. Cast iron or steel construction. Pneumatic or electrode controlled.

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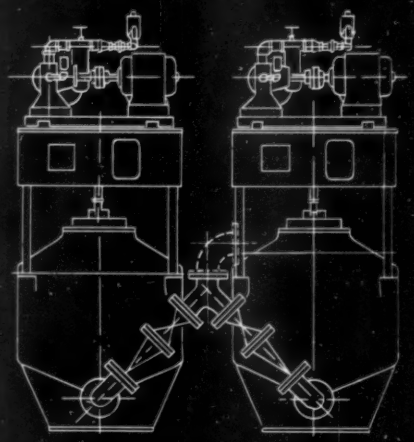

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PERFORMANCE

of Unhoused Settling Tanks in Extreme Cold Weather

R. L. SMITH,
Consulting Engineer,
St. Paul, Minn.
and
OTTO W. KUEHNE,
Plant Superintendent,
International Falls, Minn.

BIDS WERE taken for the construction of a waste treatment plant at International Falls, Minn., in the fall of 1956. The plant, which was described in the May, 1957, issue of PUBLIC WORKS, now has had about 15 months of operation. The primary and final settling tanks are not housed and the filter, though housed, provides both excellent aeration and a liquid chilling type of design. However, icing conditions can be a problem for about 6 months of the year.

For the period from November 15th, 1956, until March 15th, 1957, the minimum temperature for each day did not get as high as 32 degrees. The primary tank is of the Spiraflo type with the scum following the periphery of the tank to the outlet and the large volume of liquid passing under the skirt up to the effluent weir. Ice, to a depth up to one-half inch, formed ahead of the scum discharge trough but this ice was easily broken and discharged with the scum. The average holding period for the primary tank exceeds two hours.

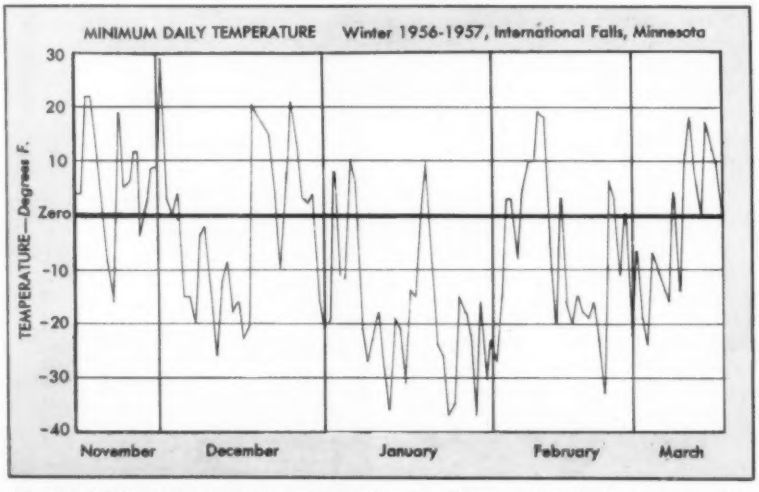
After passage through the primary settling tank, the sewage enters a high capacity distributor using prefabricated tile media. The distributor uses rain-like action and as the media resembles a huge swiss cheese with one-inch vertical holes, the aeration conditions and, by the same token, the chilling conditions, were very close to maximum. The liquid was recirculated approximately 100 percent.

After the filter, the liquid passes through a dual rectangular tank with a surface overflow rate of 800 gallons per square foot at 1500 gallons per minute. Freezing conditions in the final tank consisted of about one-half inch of ice on the outside walls. In both primary settling and final settling tanks, the thin sheet of ice appeared to serve as an insulation and to prevent heavy icing. Wind appeared to be the cause of more icing than low temperature.

● DOME-shaped structure in foreground is the covered high rate filter. Secondary settling tank, left foreground, like the primary tank, developed ½ inch of ice.

The International Falls sewage does not contain any material amount of industrial wastes to warm the sewage, the temperature conditions being largely caused by ground temperature at the sewer depth. The incoming plant sewage, during the cold part of the winter, was 52°F. and the plant effluent was never below 44°F. This eight-degree drop is higher than in most plants but probably is a product of the large-volume of recirculation over the filter.

The plant is designed to process the waste from 10,000 people, has an hydraulic flow capacity of 1500 gpm and a design flow of 750 gpm under normal conditions. The raw sewage has a BOD of 300 mg/L. The filter is housed using a prestressed concrete dome.



● MINIMUM daily temperature chart shows conditions under which plant operated.

Sewage Pump Well Elevation Held at 114.5′±3″ Despite Big Variations in Flow

Three of four E-M 200 hp, 1200 rpm Vertical Synchronous Motors with Adjustable-Speed Magnetic Drives at Nut Island Sewage Treatment Plant of the South Metropolitan Sewage System in Quincy, Massachusetts.

E-M Vertical Synchronous Motor and Magnetic Drive Unit for adjustable-speed power transmission to vertical centrifugal pump. The ring element (1) mounted directly on the motor shaft turns at motor speed. The magnet element (2), mounted inside the ring element, has no mechanical connection to the motor . . . torque is transmitted through magnetic flux linkage between ring and magnet. By varying amount of excitation to magnet, pump speed can be precisely controlled.

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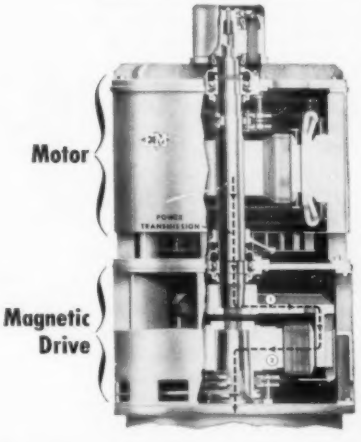

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New Developments in Photogrammetry

H. A. RADZIKOWSKI,
Chief, and
S. E. RIDGE,
Assistant Chief,
Division of Development,
Office of Operations,
Bureau of Public Roads

A REVIEW has been made at Toronto, Ontario, Canada, of several more substantial steps that have been taken in the development of the integration of photogrammetry and electronic computers into the terrain analysis process for the location of highways and the geometric stake out on the construction site. These steps are: 1) Airborne radar scanning and recording of terrain profile for use in establishing map scale and in bridging ground control from known ground monuments; 2) Automatic orientation of aerial photographic pairs in a stereoplotter to form an accurate three-dimension image of the terrain where a highway may be located; and 3) Automatic measurement and recording of the elevation of the original ground along the line where the highway may be located from these dimensional photograph images.

The instruments were developed by the Photographic Survey Corporation, Ltd., of Toronto, Canada, which specializes in the airborne science of precise exploration and delineation of the earth's surface. The Corporation is affiliated with Hunting Associates, Ltd. Another affiliate, Photronix, Inc., of Columbus, Ohio, under the direction of Everett S. Preston, Chief Engineer, is developing methods for the integration of the new instrumentation into the highway work flow process.

Airborne Radar Scanning

Estimates indicate that under current practices, up to 60 percent of time and cost of photogrammetry can be attributed to establishing ground controls which will identify the ground locations and three-dimensional scales of air photographs.

Under the new system, airborne radar instruments are synchronized to airborne cameras and a radar scanned terrain profile is taken at the same time as the air photographs. The radar records the height of the airplane above the terrain. A second instrument which is a sensitive pressure altimeter or hypsometer is synchronized with the radar and the airborne cameras to, at the same time, record the height of the aircraft above sea level. The latest airborne profile recorder carries the symbol MK-5 and, for the purpose of brevity, is referred to as the APR system.

It will now be possible with only a known ground location at or near the terminus of highway projects to identify the ground location and three-dimension scale of the entire air photograph strip of the highway. The terrain profile obtained through the APR process can be used in what is called "bridging" in photogrammetry to determine ground location and elevation. It will also provide a much easier and more accurate method of employing photogrammetry for preliminary location purposes in inaccessible locations.

Photographic Pairs

Aerial photographs with an overlapping field of view are taken of the possible ground locations of a highway in order to obtain a three-dimensional image of the terrain in a stereoplotter. This is equivalent to establishing conditions similar to those which produce depth perception in the human eye. It previously required a considerable amount of the time of a highly skilled photogrammetrist to adjust each photograph to the proper height in the stereoplotter to represent correctly the relative position of the airplane when the picture was taken.

The newly developed automatic scanning correlator called AUSCOR automatically adjusts the photographs in the stereoplotter in a matter of minutes. This is accomplished through a system of electronics and electro-mechanics which senses the relative displacement of the images of the two photographs and then adjusts the position of the photograph in the stereoplotter to bring the images into focus.

Measurement of Elevations

When the terrain space model is established on the stereoplotter from the properly oriented aerial photographs, it has previously been necessary for a highly skilled photogrammetrist visually and manually to adjust the stereoplotter to obtain the vertical measurements of the terrain where a highway may be located. It was also necessary that numerical information obtained in this manner be punched on cards or tape before it would be used in an electronic computer. To produce a contour map, it was necessary for the skilled operator manually to move the plotter head through the model keeping it on the lines of equal elevation by visual means.

Under the new development, the sensing head on AUSCOR is coupled to a metering device adjusted to the proper vertical scale of the model. As the sensing head is moved about horizontally by the operator, AUSCOR raises or lowers it with changing elevations and transmits this vertical movement to the metering device.

The inventor of the device, G. L. Hobrough, of Photographic Survey Corporation, Ltd., is of the opinion that through the use of this device, the speed of profiling at certain map scales will be increased up to 100 times as compared with a human operator.

AUSCOR is considered as a major breakthrough for the eventual automatic production of contour maps where needed. In producing contour maps, the sensing device that now automatically controls the vertical movement to obtain elevations will, when the additional controls are developed, automatically control the horizontal movement of the plotter head along lines of equal elevation.

The machine when placed in operation removes the tedious and routine repetitive work from the photogrammetrist through equally reliable automatic control and read out of vertical heights, especially towards the end of a busy day when a human operator constantly using his eyes may tire.

The next step will be to couple the metering device on AUSCOR to magnetic tapes for automatic recording and storing of the three-dimensions of the scanned terrain. This will reduce the need for contour maps for final highway location purposes by automatically analyzing on an electronic computer the location of a highway on the terrain model stored on the magnetic tape.

It is estimated that AUSCOR will, even in its present state of development, increase the speed of obtaining terrain information by photogrammetry for highway engineering use by a factor of four. Additional development now contemplated should substantially increase this estimate.

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DIGITAL COMPUTERS AND THREE MUNICIPAL WATER PROBLEMS

DAN A. BROCK,
Analyst and Statistician,
Dallas City Water Works,
Dallas, Texas

THE DALLAS City Water Works uses digital computers to solve three types of waterworks problems: (1) Remaining days of storage in a surface reservoir, (2) expected annual maximum day water consumption, and (3) effects of relocating inputs—from elevated storage and pumps—on a homogeneous pressure distribution system.

The problem of remaining days storage is not universal, but it is bothersome to officials of a surface supply system who face a worrying public. In Dallas during the last few years, the draft on the primary reservoir was exceeding its safe yield, and a constant problem was evaluation of probable remaining storage based on hypothetical combinations of expected runoff and draft. Although this problem was of concern, the solution was not sought until after heavy rains of last spring had filled the new reservoirs.

It was found in this case, as in so many practical problems, that the differential equation could not be readily solved. Therefore the problem was restated in terms of increments rather than derivatives. It could be seen how the various entities in the equation were affecting each other, making it possible to set a machine to making the motions, getting new values of the dependent variable (reservoir storage) at the end of each sequence of operations.

The problem was programmed for the Royal Precision LGP computer by the Dallas office of Royal McBee Corporation. The primary input data and formulation are shown in Table 1. This particular computer is loaded with data and instructions as it reads paper tape; a typewriter punch unit is a part of the computer. Data output, or answers, are printed by the typewriter unit.

In this problem it was desired to know how long it would take to deplete the surface reservoir assuming a continuing severe drouth. Actually the city was building up emergency supplies to perhaps a 100-mgd safe yield, but wanted to have some idea on when full dependency on ground water and other emergency supplies might occur. Taking the low point of water storage in October, 1956, it was found that the reservoirs would have been completely depleted in about 21 months, had the severe drouth continued. Such predictions obviously are accurate only as underlying assumptions are fulfilled, but they are quite useful in developing alternatives in operation.

This method of checking safe yields may also be usefully applied whenever a reservoir experiences a drouth more severe than the maximum design drouth. In such a case the design calculated safe yield must be recalculated to a reduced figure. It is worth while to point out that the drouth conditions assumed in design are certainly not the worst possible conditions. This is especially true where only a short run of annual runoff records are available for calculation of the safe yield.

Good estimates of possible maximum day water demand seem essential to safe and serviceable oper-

Table 1—Formulation of Remaining Reservoir Storage as a Function of Time and Stated Rates of Draft, Runoff, and Evaporation

y = reservoir storage in acre feet.
t = time in months.
$f(y)$ = surface areas of reservoir in acres $= a + by + cy^2$.
$f_a(t)$ = a draft function: can be a table of values in acre feet.
$f_b(t)$ = a runoff function: can be a table of values in acre feet.
$f_1(t) = f_a(t) + f_b(t)$
$f_2(t)$ = an evaporation function: can be a table of values in feet per month.

$$\frac{dt}{dy} = f_1(t) - f(t)\, f(y).$$

Run y to 0 and count t. Some iterative procedure must be used to approximate f(y) average or midmonth.

Table 2—Prediction Equations for Determining Maximum Day Water Consumption

$Y = -66.330 + 1.343\ X_1 + 0.680\ X_3 + 2.230\ X_4$
(99% probability level)
$Y = -51.600 + 1.342\ X_1 + 2.330\ X_3 - 0.100\ X^2_3$
$\ldots + 1.410\ X_4 - 0.404\ X_5$
(80% probability level)
$Y = -136.300 + 2.296\ X_1 + 2.330\ X_3 - 0.100\ X^2_3$
$\ldots + 1.240\ X_4 - 0.437\ X_5 - 0.738\ X_7$
(75% probability level)

X_1 = Total installed water meters on May 31 (thousands).
X_2 = Maximum temperature on date, °F.
X_3 = Number of consecutive previous days with temperature over 100°F.
X_4 = Number of weeks since one inch or more precipitation occurred in any 7 day period.
X_5 = Minimum relative humidity on date.
X_6 = Number of weeks since March 21 (used for a season factor).
X_7 = Time in years since 1946 (used for a trend factor).

This article is based on two papers presented by Mr. Brock at the 1958 Short School of the Texas Water and Sewage Works Association, College Station, Texas.

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ation of a municipal water system. In order to balance economic considerations against safety factors, maximum day consumption possibilities should be known within about 25 mgd, or about 10 to 12 percent in the case of Dallas. No comparable problem exists in small systems, where reserve capacity is often fifty to 100 percent of maximum day demand, or where adding a single well might increase capacity 25 percent.

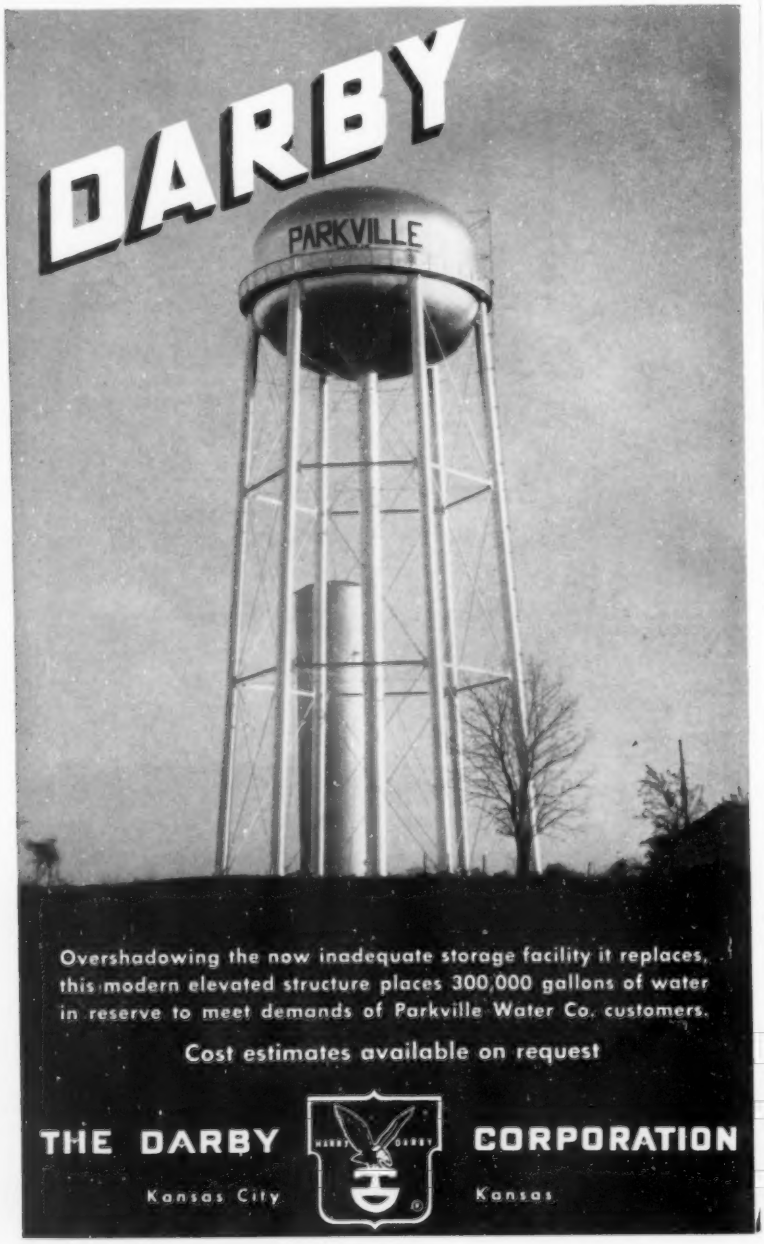
Dallas has been faced with a continually changing water demand situation. Residential areas have developed on a large scale, and lawn irrigation is a standard to which all owners of new homes seem to adhere. The changing makeup of the city and the typical Texas variations in weather, make it impossible to project accurately maximum day water consumption from one year to the next. Where a city has experienced three relatively wet and cool years at a time when 2,000 new homes were being built, how can it be determined what maximum demand for water might be in the fourth year, after six weeks without rain, and a dozen consecutive days with temperature over 100°F? Solution consists of applying, through use of a high-speed digital computer, a technique of mathematical statistics called "multiple regression analysis." The technique is new, having been developed and perfected in the 1930's, but its application often involved a terrific amount of computation. Only in the past very few years has digital computer time been available at reasonable cost for research.

The phase "multiple regression" simply refers to the relation or dependence between one variable and several other variables, as they all change. We all have worked with two-dimensional graphs showing a variable "y" changing in correspondence with a change in a variable "x". Similarly, a three-dimensional graph would be required to show "y" changing with changes in "x" and "z." Although the fact is perhaps beyond comprehension, we know that algebra can embrace any number of dimensions. Thus, for example, we can compute volumes and other values for an n dimensional figure, even though graphical representation is not possible. When we have a way of relating a dependent variable "y" to any number of independent variables, x_1, x_2, . . . x_n, we are ready to relate a dependent variable, say maximum day water consumption, to causal factors such as weather, number of water meters in service, etc. Our mathematical technique is advanced such that we can take into account nearly all suspected effects on maximum day water consumption, and then systematically check to see and eliminate which factors affect the "max-day" consumption, and to what extent they do.

This problem has been especially well programmed for the IBM 650 digital computer by the Esso Research Laboratory, Bayonne, N. J. The Esso program is available free to organizations using IBM equipment. The Datics Corporation of Fort Worth used this program when they solved a max-day problem for us, at a total cost of $212. A relation between maximum day consumption and weather factors was formulated which should be valid for two or three years.

Formulation of Problem

In developing the formulation, a day of water consumption was defined as the midnight to midnight total primary pumpage plus the net loss (or gain) in reservoirs and tanks on the distribution system. An equation was derived which relates (more than a 99 percent probability) annual peak day water con-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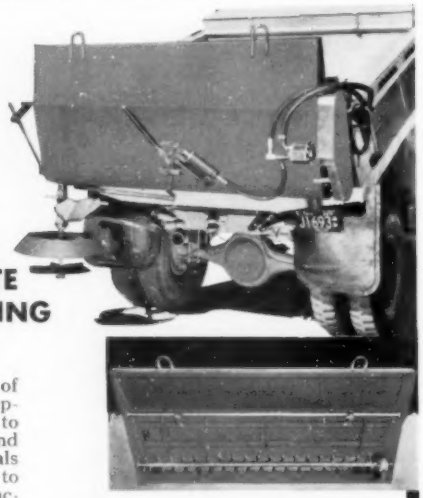

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sumption to heat and drouth. Two more equations were derived which, at lower probability of significance levels, relate maximum day consumption also to relative humidity, and to time in years (the trend).

In our analysis seven variables were used as we investigated data on peak day summer water consumption in the years 1946-1957. The variables and prediction equations developed are in Table 2.

The first equation was used for purposes of prediction. For "X" values for different years, we projected the addition of meters about as they had increased in the past few years. For maximum drouth conditions, X_3 and X_4 were used as they averaged in the years 1946-1957. Since the X_1 value of total meters installed is a substantial contributor to the predicted Y value, we could not safely predict many years ahead with the formula. Actually it might be desirable to recompute the whole equation every year or two.

The value of Y for 1957 average conditions was computed from the first equation with $X_1 = 175.780$, $X_3 = 4.711$, and $X_4 = 5.026$.

$$Y_{57} = -66.330 + 1.343\ (175.780) + 0.680\ (4.711) + 2.230\ (5.06) = 184.154 \text{ mg.}$$

For each succeeding year X was increased 6.0 thousand meters so that for 1958, Y = 192 mg; for 1959, Y = 201; and so on to 1963, for which Y = 233.

The 75 percent level equation is particularly interesting; we are hopeful that we can improve it and use it as more data becomes available next summer. A second degree (parabolic) time-in-years term might turn out more significant than the first degree term used.

These equations were developed from data associated with conditions perhaps unique as to weather, size and type of city, etc.; however, the equations may have some rough applicability in other cities.

In our problem we needed determination of ten regression co-efficients for terms we thought possibly significant. Our basic equation was:

$$Y = a + b_1 X_1 + b_2 X_2 + b_3 X^2_2 + b_4 X^2_3 + b_5 X_3 + b_6 X_4 \ldots$$
$$\ldots b_7 X_5 + b_8 X_6 + b_9 X^2_6 + b_{10} X_7.$$

Only seven independent variables were used, but three were carried to the second degree. Terms were carried to the second degree where a noticeable tapering of an effect was expected. For example, consumption could be expected to go up in proportion to meters added; but consumption, with respect to heat, would go up sharply at first

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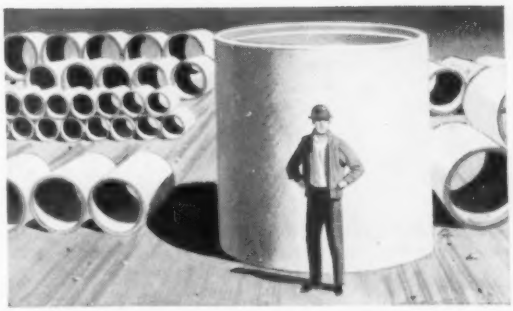

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then tend to stabilize. Preliminary investigation led us to eliminate cloud cover and day of week from the analysis; the Saturday high consumption effect has not been preeminent in the past few years.

The computations were somewhat hampered by not having a large volume of data. The earliest maximum day consumption figures date to 1946. Eventually peak and/or high consumption days in June, July, and August were used to build up our total data to 38 sets of observations.

Two apparent factors which weakened our raw data somewhat were: (1) alternately imposed lawn sprinkling restrictions and (2) more drastic restrictions when we were unable to supply the water demand.

Results of the machine run showed, and established the amount, that maximum day water consumption was affected by total installed water meters, by previous number of days over 100°, and by number of weeks since one inch or more of rain had fallen in a one-week period.

A probable association of maximum day water consumption with minimum relative humidity was indicated, with time in years since 1946, and with a second degree term of previous days over 100°. However the associations, at the 20 and 25 percent level of probability of occurrence, were not strong enough to justify using these factors to predict maximum day consumption.

No association was shown between maximum temperature on date, and actual consumption. This was rationalized on the basis that all of our peak consumption days have temperatures over 100°, and there is no significant difference to our demand say of 103° and 107°, other things being equal, except perhaps in lower humidity on a hotter day; some association of system load and humidity was shown.

The season factor was not significant, probably because the true maximum day consumption always falls within perhaps a 6-week span in the summer. The random variation expected in Y, where a set of X's is given, can be computed from the machine printout of the standard errors of Y. In our case we would expect Y to be correct within about 6 million gallons 95 percent of the time, assuming the X's were correct.

The IBM type 650 computer referred to above has a punched card data input and output. Such an input can be an advantage where a substantial amount of raw data is being entered into a machine. Key punch operators are relatively inexpensive and their transcription of data can be readily verified as to accuracy. Many organizations already use punched card billing and accounting, have equipment to punch data cards, and also equipment to print out results from computer output cards.

Relocating Inputs

Dallas is hampered as many cities are by the scarcity of engineering time which can be applied to organizing and directing distribution system design research. Engineers in our organization have on occasion, where the need was most acute, used the Hardy Cross method to balance proposed water networks. "Balance" is achieved when the system is in dynamic equilibrium—when the algebraic sum of pressure losses about each loop is zero. The Hardy Cross method is an iterative procedure for balancing pressure losses as water flows around loops in a network. The problem solution starts with a material or static balancing of the system. Static balancing will consist of so defining flows that inputs and outputs are of the

(*Turn to page* 206)

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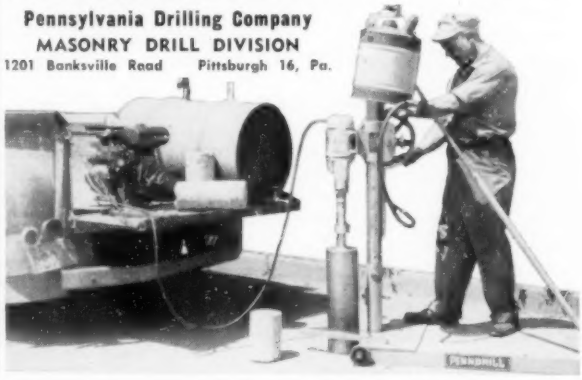
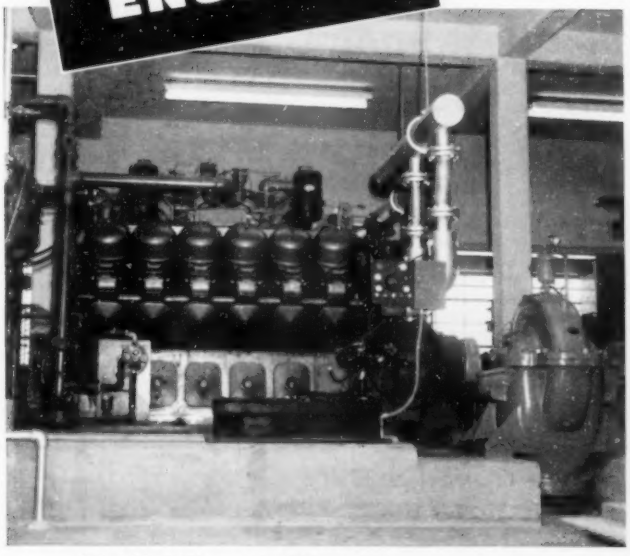
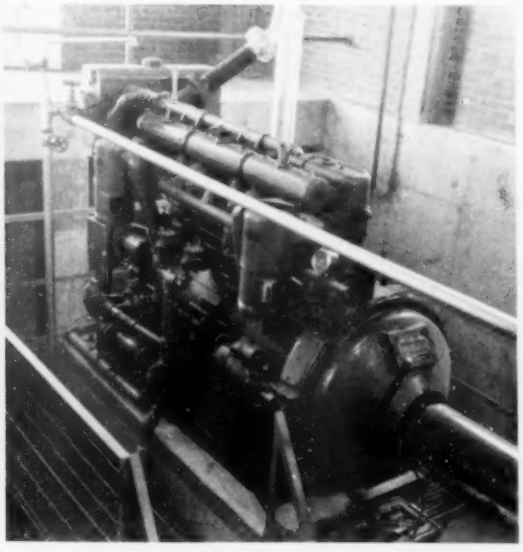


Oklahoma City's
Lake Hefner Municipal Filtration Plant

...has three ROILINE ENGINES pulling the pumps



Model L-3460, max. hp 595 at 1350 rpm on natural gas



Model F-1500, max. hp 215 at 1200 rpm on natural gas

• The municipal filtration plant of Oklahoma City, Okla. at Lake Hefner has three *Roiline* engines pulling the pumps. Pictured above are two Model L-3460 *Roilines* (max. hp 595 at 1350 rpm on natural gas) each engine pulling a ten million gallon Gould pump; and a Model F-1500 *Roiline* engine (max. hp 215 at 1200 rpm on natural gas) operating a fifteen million gallon Peerless Hydrafoil at low lift pump station. In addition, but not illustrated, is a Model L-3000 *Roiline* engine driving a 250 KVA generator. The Carson Machine & Supply Co. of Oklahoma City, Okla., made the installation. Send for Bulletins.

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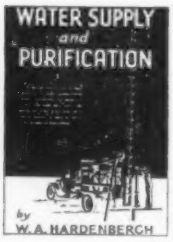

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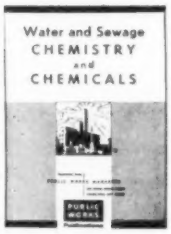

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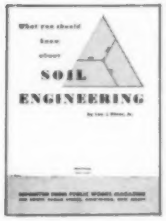

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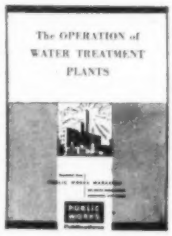

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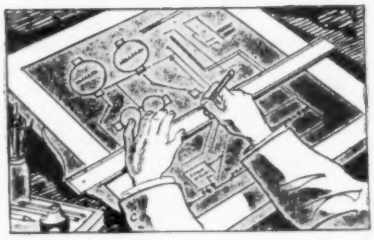

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design amounts at the designed locations, and so defining flows that in all cases flow into a point equals flow out of the point. This initial formulation can in a large system result in a substantial amount of data accumulation, and solution of the problem by hand can entail a tremendous amount of detailed calculation. Since our engineers performed the Hardy Cross computations by hand calculation, the work was quite costly; costly primarily in the sense that a key design engineer was tied to a demanding task for weeks at a time.

Now, at least two organizations in the country are equipped to compute water network solutions by applying the Hardy Cross method. The organizations in question, Service Bureau Corporation of San Francisco (formerly IBM Service Bureau) and the Datics Corporation of Fort Worth, both offer their services at a relatively modest cost; we have found that most of our network problems can be solved for from fifty to one hundred and fifty dollars. These computing service companies both furnish a complete brochure on this particular service, detailing methods of data preparation, problem solution pricing, etc. Cost of a problem solution varies with the size of a system (number of loops), its complexity, and its initial degree of dynamic disequilibrium.

We have already made substantial use of the computing machine Hardy Cross solution in checking future system design. The convenience of the machine solution makes it possible and worthwhile also to investigate our existing system. In this regard our two sets of Pitot type flow measurement and recording equipment are useful. We are using this equipment to firm up ideas on what the flows actually are in existing networks at peak consumption periods. From this point we can use the computing machine network analysis for selecting the best location for booster pumps, for best valve arrangements, for location of new lines, or for new elevated storage facilities. Since the computer solutions print out head losses as well as flow down each line, the pressure gradient, and consequent effectiveness of elevated storage etc., can be readily examined throughout the system, without further computation.

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contracted to do a specific job, and to assume responsibility for results. However, where a utility does not understand the statement and formulation of a problem, and the data processing company does not understand the operation of the utility, great care must be taken by both parties that the right problem is worked, with correctly stated conditions, and with representative raw data. Only with these precautions can we hope to obtain consistently safe and meaningful results. In dealing with the three types of problems, we made our share of mistakes before we progressed to where we could routinely achieve dependable results.

• • •

Roadside Trees

(*Contniued from page* 127)

edges of wide rights-of-way or at interchange areas where the possibility of such plantings becoming either a traffic hazard or an interference to our maintenance operations is at a minimum.

Special highway plantings of trees and shrubs are made to improve roadside appearance, to break the monotony of long stretches of relatively barren roadside, to screen certain areas, to provide a living snow fence and to help control erosion. All trees and shrubs planted are of native Wisconsin stock to insure the greatest chance of survival and to maintain uniformity in the local types of roadside vegetation. The most frequently used trees and shrubs are dogwood, hickory, ash, linden, sumac, flowering fruit trees, pines and other evergreens, and such other native materials as will most suitably fit the particular location.

Highway planting is generally done in the normal spring or fall planting season and is usually accomplished through a contract between the State Highway Commission and either the county or a private nursery for each particular highway planting project. These contracts call for the furnishing and planting at specified locations of specified types of trees and shrubs all in accordance with established nursery practice. These contracts also require that final acceptance of the work will not be accomplished until after the expiration of a certain proving period. Planting which has died during the proving period is required to be replaced under the terms of the contract.

The State Highway Commission of Wisconsin feels that the present program of removal, trimming, and planting of roadside trees is a bal-

anced one, which will provide safety for the motorist, with pleasing roadsides, and yet preserve the trees and much of the natural vegetation and ground cover. This program is generally acceptable to the many other groups who have an interest in our roadsides and should tend to promote harmony and unity of purpose between all parties concerned.

• • •

The Highway Digest

(*Continued from page* 164)

maintenance. By Duffy Atkinson, Director of Public Works, Glendora, Calif. Public Works, September, 1958.

"Street **Sweeping Operations on County Roads.**" By Dan J. Murray, Highway Maintenance Supt., Essex County, N. J. Public Works, September, 1958.

"Improving Municipal Airports." A step-by-step procedure on **airport improvement planning and financing** that will minimize delays and prevent unnecessary expenditures. By J. W. Farwell, Airport Engineer, Fay, Spofford & Thorndike, Inc., Boston, Mass. The American City, August, 1958.

"Parking Meters Buy Off-Street Parking." By John B. Wentz, Administrative Officer, Beverly Hills, Calif. The American City, August, 1958.

"Prestressing Promises Nearly **Joint-Free Concrete Highways.**" By Ben Moreell, Chairman of the Board, Jones & Laughlin Steel Corp., Pittsburgh, Pa. Civil Engineering, August, 1958.

"How Can Counties Develop An **Adequate Traffic Safety Program?**" By Hallie L. Myers, Executive Director, Indiana Traffic Safety Foundation, Indianapolis, Ind. Traffic Engineering, August, 1958.

"Site Investigations, New Code of Practice." The British Standards Institution has recently published a new Code of Practice covering Site Investigations. Many different aspects of this subject are dealt with and some of them are reviewed in the article. By R. S. Offord, BSc, DPA, AMICE. Contractors Record and Municipal Engineering, August 6, 1958.

"Pipelayer's Puzzle: **How to Cope with Quicksand.**" By C. S. Seabrook, City Engineer, Puyallup, Wash. Engineering News-Record, August 21, 1958.

"The **Three-Centered Compound Curve,** Its Design and Construction." By George W. Schults, Licensed Land Surveyor, Atlanta, Ga. Roads and Streets, August, 1958.

"Introduction to **Electronic Computers,** Explanation of Operation Given." By Robert Hansen, Washington State Highway Commission, Dept. of Highways. Highway News, July-August, 1958.

"Use of Neat Rock Salt for **Snow Cleaning and Winter Gritting.**" By Col. S. Maynard Lovell, County Engineer and Surveyor. The Surveyor, August 9, 1958.

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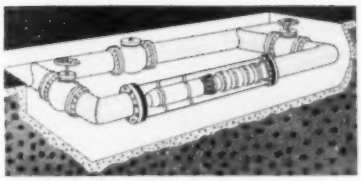


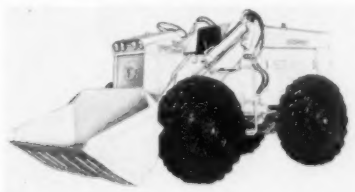
Submersible pump operates as a booster

Power-Line Submersible Pump for Municipal Water Supplies

A new Power-Line submersible pump for municipal water supplies has been announced by Layne & Bowler Pump Co. This new pump is specially designed to operate horizontally rather than vertically. Operated as a booster unit, it fits into a section of the main water pipe, allowing quick and easy removal of the pipe section and pump, if necessary. Additional advantages claimed of this new horizontal submersible concept are that there is no costly pump house to maintain, no additional property to purchase, no motor damage from heat, dust and moisture, no possibility of vandalism, and, of course, it is quickly accessible to inspection. This new unit is finding widespread acceptance for water works. For more details write Layne & Bowler Pump Co., 2943 Vail Ave., Los Angeles 22, Calif., or circle **No. 10-1** on the reply card.

Tractomotive Announces New 1¾ Cu. Yd. Tractoloader

Availability of a new 4-wheel drive 1¾-cu. yd. front end loader is announced by the Tractomotive Corp. The new 15,850-pound loader, designated the TL-16 Tractoloader, has a maximum lifting capacity of 14,000 lbs. and a breakout force of up to 18,400 lbs. For fast loading the bucket tips back 40° at ground level, and for maximum stability while travelling the bucket can be tipped back to an angle of 45° when only 14 ins. off the ground. Maximum dumping clearance under the hinge pin is 11 ft. 6 ins. Power for the unit is provided by either a 101-hp 6-cylinder Hercules gasoline engine or a 97-hp 6-cylinder Hercules diesel engine. Top travel speed in either direction is 27 mph. For safety and handling ease the TL-16 has rear-wheel power steering, and four-wheel power brakes which can be operated by either the right or left foot. For data write Tractomotive Corp., Deerfield Ill., or circle **No. 10-2** on the reply card.



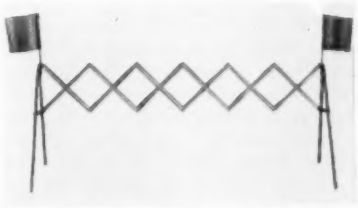
Rear wheel power steering loader has family car comfort and starting ease

400-Watt Mercury Lamp

A new 400-watt mercury lamp which is expected to provide significant reductions in maintenance costs for street and highway lighting systems which operate on straight series circuits has been announced by General Electric. New feature of the lamp is a built-in protective device against sudden surges of voltage through the line. This internal "cutout" eliminates the necessity for costly maintenance trips to replace presently used external film circuit cutouts after heavy electrical storms or other sudden surges of high voltage. Lower installation costs result from the location of ballasts and controls at a central point, rather than at each lamp. At the end of the lamp life, or under unusual conditions which actually damage the lamp, an internal arc will melt the sleeve and allow the lead-in wires to fuse and complete the circuit. Thus, the arc is extinguished before it can reach and damage the socket, and the remaining lamps in the series continue to burn normally. The lamp is completely adaptable to present series circuit systems and is designed for 3.2-amp straight-series circuit. For complete data write Press Relations, General Electric, Nela Park, Cleveland 12, O., or circle **No. 10-3** on the reply card.

Fold-up Type Emergency Barricade

Guard-Gate, a metal fold-up type of emergency barricade that can be carried in a passenger vehicle and can quickly be set up wherever needed is now available from West Side Iron Works. It is a folding, one-piece barrier that extends to 8 ft. and stands 36 ins. high when in use, yet can be collapsed to 9 ins. when not in use. An ideal traffic aid,

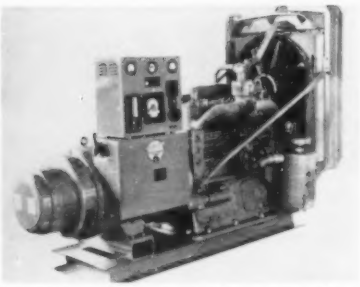


One piece emergency gate stands alone

Guard-Gate can be used for emergency highway conditions by police and highway departments, utilities, contractors and public service units to warn traffic to temporary highway obstruction. The end supports are black, cross bars are of brilliant yellow, and red warning flags are at either ends. Write to West Side Iron Works, Inc., 327 Front Ave., N. W., Grand Rapids 4, Mich., or circle **No. 10-4** on the reply card.

Electric Generating Plants

The Pioneer Gen-E-Motor Corp. has announced two units of its newly-redesigned line of electric generating plants. The new electric plants, a 1000-watt and a 1500-watt model, are the ultimate in portability, appearance and in operating performance. Fully laboratory engineered and approved, the units feature as standard equipment recoil rope starting, duplex receptacles, a pilot light and a sturdy carrying frame. Vibration is practically non-existent due to the use of rubber isomode pads. The 1000-watt unit weighs 72 lbs.; the 1500-watt unit weighs 109 lbs. More data from Pioneer Gen-E-Motor Corp., 5841-49 West Dickens Ave., Chicago 39, Ill., or circle **No. 10-5.**



Standby emergency service power plant

1800 RPM Electric Generating Sets

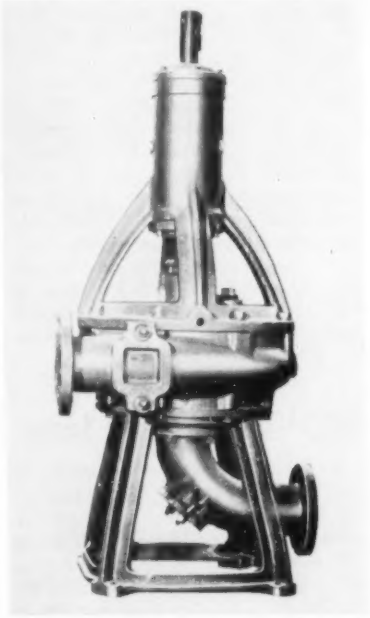
The addition of a new low cost 125-kw, 156-kva, 1800-rpm electric gasoline generating set to their standard line is announced by Katolight Corp. The unit is particularly adaptable for standby emergency service, or seasonal continuous duty. The unit incorporates a revolving field type external regulated generator of single bearing design, complete with ammortisseur windings, and direct connected exciter, directly fastened on a common heavy steel bed plate and driven by means of a semi-flexible coupling by a Hercules Model HXE, 6 cylinder, 4 cycle, gasoline engine with 935 cu. in. displacement. The unit is available in both single and three phase, complete with all the latest controls and panel equipment that may be desired to meet any specific application. Write Katolight Corp., First Ave. at Chestnut St., Mankato, Minn., or circle **No. 10-6** on the reply card.

Synchronous 400-Cycle Line Extended

Synchronous motor driven frequency chargers with 400-cycle, 3-phase output are now available as large as 250 KW from Kato Engineering Co. The unit consists of a 150-KVA, unity power factor, 120/208-volt, 2-phase, 4-wire, 400-cycle alternator mechanically connected in tandem to a 250-hp, 440-volt, 3-phase, 60-cycle, 1200-rpm synchronous speed drive motor. Complete specifications from Kato Engineering Co., Mankato, Minn., or circle **No. 7** on the reply card.

Two New Torque-Flow Pumps

Two new Wemco Torque-Flow pumps, available for the first time in a vertical as well as a horizontal model, have been announced by Western Machinery Co. In addition to being available in vertical models, the new pumps, designated Types D and DL, are also available with a variety of drives. These drive options include belt, close coupled, pedestal mounted, and extended shaft. The Type D is available in both 4- and 6-in. sizes suitable for general duty pumping of solids even at high heads and high capacities. The Model DL is a smaller version of the same pump, available only in the 4-in. size, usually used on low head applications. Both new pumps have retained the design characteristics of earlier Torque-Flow pumps. It is this radical design, featuring a recessed impeller, that makes the pump completely non-clogging and



Pump can handle solids at high heads

highly resistant to abrasion. Further information from Wemco Torque-Flow Pump Div., Western Machinery Co., 650 Fifth St., San Francisco 7, Calif., or circle **No. 10-8.**

Asphalt Tool Heater

A small, easily handled device for heating asphalt smoothing irons has been developed by Hauck Mfg. Co., for use in road patching and for building driveways and service station fronts by contractors and by municipal, county, state and public works highway departments. Known as the Mighty Midget, the heater holds two irons, and is lightweight and portable, making it particularly easy to move and use when there are 20 to 30 patching jobs a day. The heater can be operated on the ground, on the floor of a truck or permanently mounted in the truck. It is fast heating, yet safe and comfortable to work around. A split flame LP gas burner heats both smoothers at the same time. A 20-lb. bottle operates the heater for two days. It lights instantly without preheating, and produces hot, steady flames. For complete information write Hauck Mfg. Co., 124-36 Tenth St., Brooklyn 15, N. Y., or circle **No. 10-9** on the reply card.

Ring-Tite Fittings

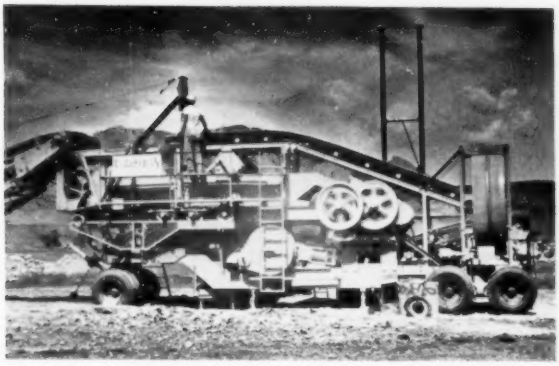
Short body cast iron fittings for use with Johns-Manville Ring-Tite Transite pipe are announced by Bathgate Foundry Co. The fittings are available in a complete range of sizes from 3 to 12 ins. inclusive. Plugs and caps are made with extra heavy boss to insure sufficient thread area when tapped. All fittings can be supplied tar coated or cement lined. For more details write Bathgate Foundry Co., Inc., Creeper Hill Road, North Grafton, Mass., or circle **No. 10-10** on the reply card.

Steam Cleaning Machines

Northeast Industries announces the new Model A90 Northeast vapor jet cleaner. There are no gauges to watch, valves to turn or adjustments to make; the Northeast machine is pre-set at the factory to give 100 lbs. of steam pressure with 90 gph capacity, including the cleaning compound mixture. With the siphon-type steam gun, the cleaning compound is introduced at the gun by means of a Venturi siphon action from a separate container. Thus, none of the cleaning compound goes through the machine, increasing the life of the coils, permitting the use of a wider range of cleaning compounds and facilitating rapid change-over from one compound to another. For more information write to Northeast Industries, Inc., Midland Park, N. J., or circle **No. 10-11** on the reply card.

Wide range of cleaning compounds can be used in this steam cleaning machine

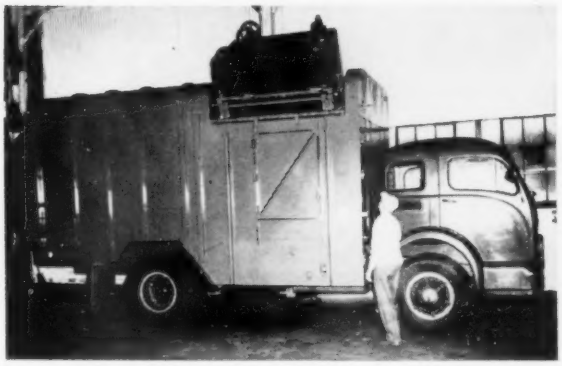
High Rate Aggregate Production



Cedarapids "Challenger" represents a new idea in crushing

A revolutionary departure from the conventional design of tandem crushing and screening plants is exemplified in the new Cedarapids "Challenger" recently introduced by Iowa Mfg. By using a high speed 12" x 36" twin jaw crusher for primary crushing, the "Challenger" is said to have from 40 to 100 percent greater primary capacity than with a conventional jaw crusher. Because of this higher primary capacity, the unit can be operated with the jaw opening reduced. This permits production of a greater percent of crushed and fractured aggregate. It also increases overall plant capacity and reduces the circulating load, as a high proportion of material is crushed to finished size by the twin jaw primary crusher. On jobs in many sections of the country, the machines are producing up to 540 tons per hour of minus 1½-in. material. Complete details and specifications from Iowa Mfg. Co., Cedar Rapids, Ia., or circle **No. 10-13** on the reply card.

Mechanical Pick-up of Refuse

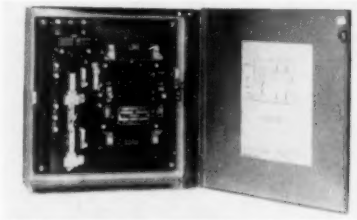


New integrated refuse pick-up system operated by one man

A new, integrated system of mechanical pick-up of trash and refuse which reduces handling and stop time is now available. The system utilizes a hydraulically operated compacting unit mounted on a truck chassis, an automatic lift and dump mechanism and a movable metal container; it is said to eliminate fire hazards and unsanitary conditions. The movable, all-metal containers, called trashtainers, are of leakproof, corrosion-resistant steel construction and are mounted on ballbearing wheels. Trashtainer units are available in 1 and 2-cu. yd. capacities, and the capacity of the special truck dump body, when fully compacted, averages more than 60 yards. More details from Equipment Mfg. Inc., 21550 Hoover Rd., Detroit 5, Mich., or circle **No. 10-15** on the reply card.

Fluomeric Lamp as a New Light Source

The new Fluomeric lamp, made by Duro-Test Corp., is said to have a life of 6,000 to 12,000 hours with almost double the efficiency of incandescent lamps; screws into an ordinary electric socket; requires no auxiliary equipment; and attains full brilliance almost immediately. To produce its golden white, full-spectrum light of great brilliance, Fluomeric combines its three light elements in this way. The pure tungsten incandescent filament provides predominantly orange light; the mercury vapor arc discharge tube supplies mainly blue and green, and the fluorescent phosphors add the deep red factor. In addition to multiple indoor uses, the lamp is recommended for outdoor service in parking lots, airports and wherever nighttime light is needed. Its hard glass bulb was developed to resist sudden temperature changes as well as to protect against the impact of insects, drafts, moisture and the corrosive action of chemical fumes. The lamps are made in wattages of 450 and 750. For date write Duro-Test Corp., North Bergen, N. J., or circle **No. 10-12** on the reply card.



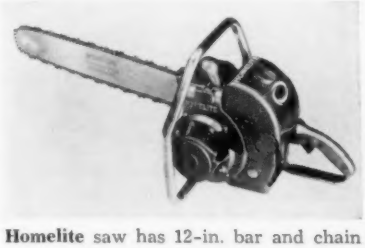
Switch requires no external relay or fuse box as all the items needed for low voltage control are on one panel

Low Voltage Control For Remote Control Switches

24-volt AC control of power and lighting circuits from any number of control stations can now be achieved through a new low voltage control arrangement for ASCO remote control switches. The complete control switch with low voltage control is designed and made by the Automatic Switch Co. Advantages of this new equipment includes safety, reduction in cost of initial installation, increase in permissible line run and no external relay or fuse box. For complete information, write Robert C. May, Director of Sales Promotion, Automatic Switch Co., Florham Park, N. J., or circle **No. 10-14** on the reply card.

Fast Cutting Chain Saw

A chain saw that can cut 18-in. trees in 18 seconds is announced by Homelite. Features include short-stroke engine design, all position diaphragm carburetor, automatic clutch and safety chain guard, and large air filter and fuel tank. The 18-lb. saw has enough dependable power to cut trees to 3 ft. in diameter. Blades come in a variety of sizes, ranging from 12 ins. to 21 ins. For further information write Homelite, Port Chester, N. Y., or circle **No. 10-16** on the reply card.



Homelite saw has 12-in. bar and chain

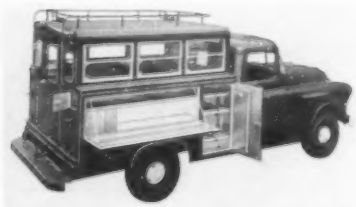
Three-piece Pacal section being pointed out on a Washington County, Minn., grader

Grader Blades That Have Thicker Center Section

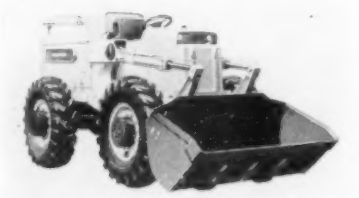
Paper, Calmenson & Co. recently announced a new system of installing grader blades. To reduce the crowning effect so the blades stay straight on the bottom, this new blade arrangement consists of a thicker hardened blade in the center, and two conventional blades on the ends. These blades are 8 ins. wide with standard blade curvature. One section is ½ in. thick on top and ¾ in. thick on the bottom. The other is ⅝ in. thick on top and ⅞ in. thick on the bottom. This keeps the waste portion or top of the blade down to a minimum and adds extra wear to the bottom. The 6 to 8-ft. long hardened center blade is ¾ in. thick on the wearing portion and the 3 to 4-ft. long ends are ½ in. thick and not hardened. For more write Paper, Calmenson & Co., County Road B and Walnut St., St. Paul 8, Minn., or circle **No. 10-18.**

Vehicle For Surveying Parties

Designed specifically for surveying parties, Utility Body Company's new Series P-A surveyor body fulfills all the requirements so essential to today's modern surveyor. The interior is weathertight with three opening aluminum sash windows on each side to give visibility. There is a dome light and the roof is insulated with fiberglass and masonite lining. The front of the body features an adjustable ventilator. The body includes full compartmentation completely laid out for the storage of surveying instruments, equipment and supplies. Long shelves for rods and tripods are lined with masonite and other shelves are lined with plywood or rubber. For further information write Utility Body Co., 1530 Wood St., Oakland 7, Calif., or circle **No. 10-17** on the reply card.



Surveyors and survey crews can find this vehicle ideal for transportation



Hough Announces New Model H-70 Tractor-Shovel

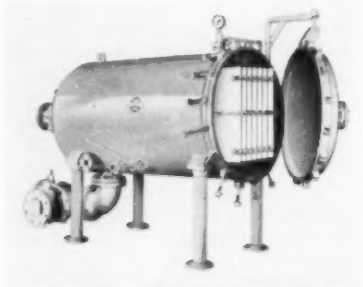
A new four-wheel-drive, rubber-tired tractor-shovel with 7,000 lbs. carry capacity, the Model H-70, has been announced by Hough. Features of the new H-70 include more power, more traction, stronger components, greater protection against dirt and dust, more efficient torque-converter, complete power-shift transmission, power-transfer differentials, power-steering, pry-out bucket action, safety boom arms and power-boosted brakes. New and more powerful gasoline and diesel engines provide from 105 to 110 hp. Diesel engines are available in either 2 or 4-cycle types. Improved weight distribution provides an additional 1,500 lbs. of weight on the rear wheels making possible better traction and greater digging effort. Complete details from The Frank G. Hough Co., 761 Seventh Ave., Libertyville, Ill., or circle **No. 10-19.**

New Stall-Free, Clog-Free Power Snow Remover

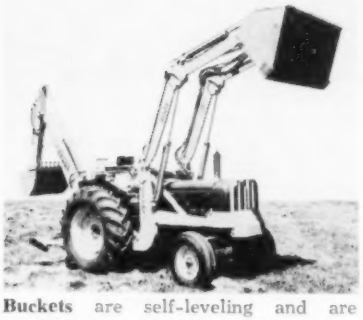
The Snow-Bird, a powered snow remover that actually uses the snow to help pull it along, is now available from George Garden Tools. Feeder blades break up frozen crusted snow, as well as feed wet snow into the high speed blower fan. The snow is then thrown out through the discharge chute, which may be directed to right, left, front or back. It is claimed that the unit cannot stall, even in deep snow, and that self-cleaning blades prevent snow from clogging or jamming in hopper or chute. It is self-propelled, so the operator just steers it. Features include: 2¾-hp Briggs & Stratton engine with recoil starter; fully enclosed geared transmission; 2 clutches, one master clutch for quick, positive stop, one to disengage power from wheels; and adjustable scraper blades. For more information write George Garden Tools, 811 S. Hamilton St., Sullivan, Ill., or circle **No. 10-20** on the reply card.

Diatomite Water Filter Suspends Plates From Roller Carriages

A new diatomite water filter called the Model RJ is announced by Sparkler Mfg. Co. The unit is said to reduce markedly bacteria and to remove all visible sediment and organic matter, producing water of zero turbidity. The unit is slurry fed and employs synthetic cloth covered filter plates which hang from roller carriages for easy inspection and removal. It has a modern built-in jet spray for flushing which is said to be superior to old backwash methods. Plates join self-sealing manifold openings and seal without bolts or fastenings. This construction principle reduces service time and also eliminates the need for headroom above the filter. Write Sparkler Mfg. Co., Mundelein, Ill., or circle **No. 10-21** on the reply card.



Water filter is slurry fed and uses synthetic cloth covered filter plates



Buckets are self-leveling and are available in a 60-inch or 66-inch size

Henry Tractor Shovel For Fordson Major Tractor

The introduction of a new tractor shovel built specifically for the Fordson Major tractor, has been announced by Henry Mfg. Designated as the Henry 900 tractor shovel, the unit has a self-leveling bucket, bucket position indicator, and many other outstanding features as standard equipment. It has a breakaway capacity of 5,000 lbs. and a lifting capacity of 3,000 lbs. to a full height of 9 ft., enabling it to match the rugged operating requirements of the Fordson Major Tractor. Maximum tilt back of its bucket is 25°, while the bucket's maximum dump angle is 50°. With the bucket at a 40° dump angle at 9 feet, the unit has a reach of 33 ins. Two different bucket sizes are available: a 60-in. bucket having a capacity of ¾-yard heaped or ⅝-yard struck; and a 66-in. bucket with a capacity of ⅞-yard heaped or ¾-yard struck. For full details write Henry Mfg. Co., Inc., Topeka, Kans., or circle **No. 10-22** on the reply card.

Compact Office Photocopy Machine

Lightweight and portable, the APECO Director "Auto-Stat" is a desk-top model that will reproduce any original office-sized document in approximately 19 seconds. Features include single push button control, continuous automatic feed operation, and functional styling resulting in extreme ease of maintenance. The Director produces sharply defined black on white copies of any written, printed, typed, drawn or photographed original. It operates on standard electric power. The model is compact, measuring 11 ins. deep by 5½ ins. high by 20½ ins. long. It weighs only 25 pounds. For full details write American Photocopy Equipment Co., Evanston, Ill., or circle **No. 10-23** on the reply card.

Detector For Pipeline Inspection and Location

Tinker & Rasor, inspection instrument manufacturers, announce development of a Pearson type detector for pipeline inspection and location. The Model PD Pearson detector is extremely useful to public utility, pipeline or municipal organizations in the performance of three types of work. It can locate discontinuities in protective pipe coating in pipe buried at normal depths and can locate these "holidays" from the surface of the ground and without uncovering the pipe.

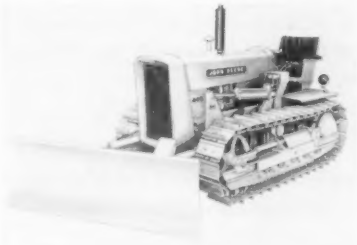
The detector can locate electrical shorting between two pipelines or between a pipeline and some other metal structure. Finally, it can trace an individual pipe line including its branches, through a maze of buried pipe in city streets when the systems are not electrically connected. In operation, the detector makes use of a transistorized oscillator. This oscillator is powered by any standard 12-volt auto battery and develops 25 watts of 750-cycle audio signal with a conversion efficiency of 70 percent. The unit, including carrying case, without storage battery, weighs less than 20 lbs. Specifications and operating data are available from Tinker & Rasor, P. O. Box 281, San Gabriel, Calif., or by circling **No. 10-24** on the reply card.

Improved All Purpose Line Striper

An improved version of the popular Model 3-10 M-B line striper is now offered by the M-B Corp. This striper is particularly suited for striping cross walks, parking lots, aisles and center lines. The unit now has a handy recoil starter with automatic rewind on the 3-hp engine for quick, convenient starting. A new, separate 1½-quart solvent cleaning tank for complete flushing of gun and hoses helps to keep guns operating more efficiently. An extension on the paint tank filler opening has been included to allow the use of large strainer-type funnels when pouring paint. Features include single or double-line marking, 2 to 6-in. lines, straight or curved; line laying capacity up to 10,000 feet per hour; hand-propelled or self-propelled models; a 11.2-gallon paint tank with paddle type paint agitator; hand paint spray gun; outboard spray guns for striping close to curbs and buildings; and a rotary-type reflective bead dispenser. Complete information from the M-B Corp., New Holstein, Wisc., or circle **No. 10-25** on the reply card.

Unit has wide use in municipalities

New Line of Deere Tractors

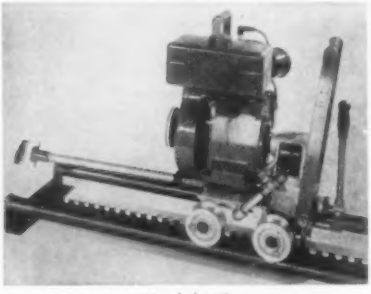


John Deere announces the availability of the 430 crawler (4 and 5-roller), the 430 wheel tractor and the 330 wheel tractor. New matching John Deere industrial equipment includes the 64 all-hydraulic bulldozer for the 440 crawler, and the following attachments for the 71 wheel tractor loader: bulldozer blade, crane, and a materials handling bucket. Also, loaders, dozers, and winches are available For further data write John Deere Industrial Div., Moline, Ill., or circle **No. 10-26** on the reply card.

Automatic Trash Pick-Up Machine

The Dude, announced by the Arrow Sales Co., is two cleaning machines in one. By using two interchangeable attachments the Dude answers two different purposes in the cleaning field. With the 8-in. wide scoop the unit cleans large areas and gets in all the hard to get at places and eliminates hand sweeping. The 8-in. hose works easily in between seats and seat rows and is large enough to pick up popcorn boxes, dixie cups, newspapers and programs. For large open areas, the machine scoop attachment cleans parking lots, side walks and ball parks. For more details write the Arrow Sales Co., P. O. Box 5023, Columbus 12, Ohio, or circle **No. 10-27** on the reply card.

EBMI
Underground Boring Machine
New! Improved!



Model 40

- **BORES**—with no surface break
- **BORES**—up to 250 feet in length
- **BORES**—up to six inches diameter
- **BORES**—so drill stem of pipe of conduit stays
- **BORES**—1,000 feet on 1 Gal. of gas
- **REAMS**—up to 12 inches diameter

Write immediately for information.

EARTHWORM BORING MACHINE, INC.

P. O. Box 1100
Santa Monica, California

What you should know about

SOIL ENGINEERING

SOIL engineering is the practical application of engineering principles to problems involving the use of soil, either in its natural condition or as a construction material. In this authoritative booklet all phases of soil engineering are treated in simple, easily understandable language. Full information is provided on basic soil properties, classification systems, field and laboratory tests, frost action and compaction. Liberally illustrated and containing many special charts and graphs to assist the engineer in his work.

ORDER from Book Department, PUBLIC WORKS, 200 So. Broad St., Ridgewood, N. J. Only $1.00 per copy.

Cab protects operator from bad weather

All-Weather Cabs For 'Michigan' Tractor Shovels and Dozers

The Construction Machinery Div. of Clark Equipment Co., now offers a full line of all-weather cabs for "Michigan" 1¼ to 6-cu. yd. tractor shovels and 162 to 600-hp tractor dozers. The cab protects the operator from wind, dust, rain, snow and cold; yet permits all-around and overhead visibility. The heavy-duty all-welded-steel cab can be installed easily in the field. All windows are of safety glass, set in rubber molding. The rear window is hinged for opening and can be completely removed. The door on the left side pivots about one point for easy entry and exit. Simply by removing one cap screw, the operator can take off the door for summertime use. Heater, windshield wiper and floormat are optional. For further information write to Construction Machinery Div., Clark Equipment Co., Pipestone Rd., Benton Harbor, Mich., or circle **No. 10-28** on the reply card.

Chevrolet Trucks For the Public Works Field

Substantially increased fuel economy in the light-duty line, a new optional power train for two heavy-duty Series, a wider range of optional equipment, and numerous engine and chassis improvements feature the 1959 Chevrolet truck line. The number of models offered is 139, on 22 different wheelbases. Gross vehicle weight ratings range from 4,000 to 36,000 pounds. In the light-duty series, major emphasis is on fuel economy, with an improved six cylinder engine. On the half-ton series, further fuel saving is available from an optional carburetor-rear axle combination for the economy six engine. More load space is provided on the ¾-ton stake models as a result of increased rack body length. They now measure 98 ins. inside length. An improvement in the 261-cu. in. six, as well as in all Chevrolet-V8 truck engines, is a new thermostatically-controlled by-pass cooling system. Highlighting features of the heavy-duty line is a new optional power train for 70 and 80 series trucks. It consists of a 185-hp. 348-cu. in. engine, heavier clutch, close ratio five-speed or Powermatic transmission, and a 16,000-lb. single rear axle or 30,000-lb. tandem. Performance of all engine-driven assemblies is more efficient on all models of the 1959 truck line because of new extra-strength, low-stretch V-belts on all drives. For further details see your local Chevrolet Dealer, or circle **No. 10-29** on the reply card.

New heavy-duty 1959 Chevrolet tandem

Kelley Power Tamper

A powerful, self-propelled, compact power tamper for packing down earth backfill in trenches and around foundations and piers and for blacktop paving and patching has been developed by the Kelley Machine Division. The Model 18KT has an 18-in. wide shoe with a 24-in. also available. To prevent black top sticking to the shoe, a special heater attachment for the shoe can be furnished. The Kelley power tamper has a 4-cycle gasoline engine with 3.5 hp. It delivers 2400 one-ton impacts per minute. Shock-absorbing handles do not transmit vibration to the operator. For more details write Kelley Machine Div., Wiesner-Rapp Co., Inc., 285 Hinman Ave., Buffalo 23, N. Y., or circle **No. 10-30.**

GROWING PAINS FOR A COUNTY

Albemarle County is currently faced with various problems resulting from "growing pains", and this letter is for the purpose of seeking certain information as a possible solution to our problems.

Due to the rapid expansion of subdivisions, there has come upon the scene the possible operation of water and sewerage systems by private operators. Although there is a State law which requires that such systems be approved and controlled by the governing body, a number of problems are in the offing.

This letter is for the purpose of asking if your office may have on file any rules, regulations and/or ordinances which have been adopted by localities controlling the installation and operation of such private utilities. This county is most interested in any criteria which would give assurance as to sufficiency of water supply for the proposed area to be served as well as the guarantee as to continuity of operation regarding both water and sewerage.

Any such information you or your readers may have and can send me will be deeply appreciated.

M. M. Pence
County Executive
Albemarle County
Charlottesville, Va.

Editor's Note: Some information has been sent Mr. Pence. We trust our readers will be able to supply him with data on their practices, sending a copy to the Editor.

SNOW PLOW INFORMATION

We have read your editorial on "Some Needed and Useful Inventions" in the June issue. I realize this was written in part on a humorous note, but you may be interested to know there are several devices to restrict the snow plow discharge while passing driveways. To my knowledge none is in production. But as a residential property owner, your point is well taken.

H. S. Frink,
Frink Sno-Plows, Inc.,
Clayton, New York

NEWS OF ENGINEERS

ELLIS L. ARMSTRONG, Utah State Director of Highways, has been named Commissioner of the Bureau of Public Roads.

MAURICE MARTIN has been appointed Director of Highways for the State of Kansas.

SCHUPACK & ZOLLMAN is a new firm of consulting civil engineers. The principals are C. C. Zollman of C. C. Zollman & Associates, for the past ten years engaged in precast and prestressed concrete engineering; and M. Schupack, previously vice-president and Chief Engineer of the Preload Co. The new firm, which has offices at 3605 Chapel Road, Newtown Sq., Pa., and 211 E. 37th St., New York, will specialize in precast and prestressed concete, in which field both principals have had much experience.

L. L. HEDGEPETH, well known in the sanitary field, died at his home in Bound Brook, N. J., Sept. 3. He was a long-time employee of the American Cyanamid Co. and was also Adjunct Professor of Sanitation at Rutgers University.

W. C. HUNTINGTON, formerly head of the Civil Engineering Department of the University of Illinois has become consultant with Harland Bartholomew & Associates of St. Louis, Mo.

Strip Lighting for Long Beach Airport Tunnels

A brief account of the lighting used for the Long Beach, Calif., airport tunnels appeared in our August issue. The tunnels were designed by Moffatt & Nichol, consulting engineers of Long Beach, for the City of Long Beach. The electrical engineering design was done for Moffatt & Nichol by Randolph & Johnson, electrical engineers, also of Long Beach. The project utilized a form of strip lighting, with fluorescent tubes, to provide very effective lighting.

CLASSIFIED ADVERTISING

ENGINEER WANTED

ENGINEER for position in Sanitation Division of the Maricopa County (Phoenix) Health Department. Assistant to the Director of Sanitation. Salary range $527-$641. Degree in engineering and several years experience in work closely allied to Public Health work.

Apply to:

Arizona Merit System
11 North 17th Avenue
Phoenix, Arizona

Position Available — Assistant Director of Public Works, City of Rahway, New Jersey

Graduate civil engineer, with one year experience in construction or public works. To assist in supervision and planning of streets, sanitation, parks, maintenance activities. Salary range $5,000 to $7,000. Good advancement possibilities for qualified man. Civil service benefits and security. Rahway resident preferred but all applications will be considered in terms of qualifications. Send resume and application to Business Administrator, City Hall, 1470 Campbell Street, Rahway, New Jersey.

ENGINEER WANTED

A firm manufacturing equipment for sewage treatment needs a sanitary engineer who is interested in learning how to sell and to provide technical service through field representative. Location in the East-Northeast. Moderate travel will be involved. Write to Box T-10, Public Works Magazine, 200 South Broad St., Ridgewood, N. J.

Sales Promotion, PR and Advertising Man Available

A man experienced in sales promotion, advertising, public relations, editing, photography and convention and exhibit participation is available. He is 35 years old, married, 3 children, BS degree, wide experience in above fields. Prefers location in East. Write Box W-10, Public Works, 200 South Broad St., Ridgewood, N. J.

26 FOOT HOUSE TRAILER

Ideal for construction field office, mobile photographic darkroom or studio, or as is, a well appointed completely furnished living quarters for one to four people. Air conditioned, only slightly used. $1650, F.O.B. Englewood, N. J.

Write to:
Box 86
Ridgewood, New Jersey

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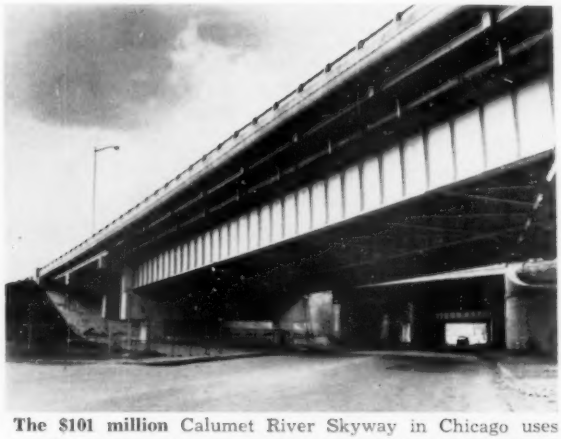
Versatile IH Drott 4-in-1 distributes first bedding layer in a pipeline excavation. After this was tamped in place, balance of fill was bulldozed from near side and the Skid-Shovel reached across to backdrag material from the other side. Contractors Van Allen and Motter of Richmond, California, own the unit shown.

—Worth Seeing

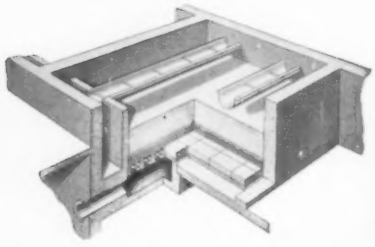
Smoothing six inches of special sub-grade material during a widening project on Route 8 south of Butler, Pa. One side of Blaw-Knox subgrader is riding on 9-inch B-K road forms. A vibration method is employed to shave off excess material.



The $101 million Calumet River Skyway in Chicago uses nearly 400 tons of Byers wrought iron pipe for drainage lines. This material was chosen to resist atmospheric corrosion as well as effects of water saturated with ice control chemicals.

Near the largest traffic count location in Tennessee—8th Avenue and Broad Street, Nashville—this new Kerrigan Iron Works rigid frame sign support spans the street. Structure is designed for spans of 100 ft. or more and is made to withstand wind velocities up to 120 mph. Available in steel or aluminum, the rigid frame makes it possible to use smaller spandrel beams.

Only
Leopold
GLAZED TILE
FILTER BOTTOMS
Successfully meet all underdrain requirements



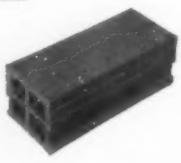
Filter unit showing Leopold Filter Bottom and Leopold Fiberglass-Reinforced Plastic Wash Troughs

Performance Proved in over 375 plants with a daily capacity of more than 2¾ billion gallons!

In this design, laterals and distributing blocks form a permanent unit that assures equal filtration and uniform wash distribution with low loss of head. Made of de-aired fire clay—vitrified and salt glazed—the blocks can't corrode, won't absorb water, are acid and alkali resistant, and are not subject to tuberculation.

In addition, the Leopold Filter Bottom needs only a shallow depth of small-sized filter gravel, does not require supporting concrete structures, and is the only design providing a fixed and controlled secondary backwash.

Literature and Complete Details Furnished on Request!



Leopold
F. B. LEOPOLD CO., INC.
Zelienople, Pa.

COMPLETE WATER TREATMENT PLANT EQUIPMENT

by Arthur K. Akers

★ HERE is the happy opening of new Chicago headquarters at 4935 West Belmont Ave. of the Hersey Manufacturing Co. (water meters to

us). Winthrop P. Hersey, president, is in center, Chicago manager Michael H. Foley, left; J. W. Lyden, sales rep., right.

★ MOUNTING, deepening interest in all aspects of water resources was evidenced in Chicago in late August by a meeting sponsored by the Illinois State Chamber of Commerce. President Harry E. Schlenz of Pacific Flush Tank Co., presided, and our own Bob Shea of Chicago who attended, reports a responsive audience of 400.

★ INFILCO Inc., Tucson, Ariz., appoints C. T. VanderMolen assistant sales manager and H. W. Frazer, Industrial Project manager. L. H. Piper heads the new Project Engineering department.

★ HAMILTON KENT MFG. CO., Kent, Ohio, appoints Anthony J. Reto sales manager, Coupling Div.

★ ROBERT S. WARREN becomes advertising manager, Cooper-Bessemer Corporation (diesels), Mt. Vernon, Ohio, in place of E. R. Bonnist, deceased. Warren was handling the C-B account previously in the Griswold-Eshleman advertising agency, Cleveland.

★ ROBERT J. SHEA, midwest sales manager, PUBLIC WORKS Publications, in Chicago, has been elected president of the t.f. Club of Chicago, an organization of topflight advertising space salesmen.

★ A PLEASANT visit at the National Slag Association offices in Washington recently reveals that our good friend E. W. Bauman, managing director, participated in the Buffalo Slag Company's 45th anniversary celebration, including an inspection tour of important Buffalo area construction projects where slag has been used.

★ GRAVER Water Conditioning Co., New York, keeps expanding. Now revamped, the set-up includes Robert Dvorin heading the Industrial Waste Treatment department, and R. S. Lewis, sales promotion. V. J. Calise remains general sales manager.

★ GEORGE L. ILLIG Jr. has been named assistant to the vice president of industrial chemical sales, Hagan Chemicals & Controls, Inc., Pittsburgh.

Mr. Illig

Mr. Cropsey

★ H. KENNETH CROPSEY is new sales manager, Weldforged Grating Division of Kerrigan Iron Works at 280 Madison Ave., New York, succeeding D. D. Connors, deceased.

★ JAMES B. CLOW & SONS, Inc. elects vice president of manufacturing Thomas A. Ripley to its board of directors.

★ THE ESKRIDGE EQUIPMENT CO., Tulsa, Okla., has taken over the manufacturing and sales activities of Welded Products Co., Oklahoma City. The first of the new EECO models, a pneumatic roller, came off the assembly line on August 1.

★ WORK and save, young man, and some day you'll have enough to divide with those who don't.

—*Dickey Data*

Penetrates through rust
like coffee soaks into a sugar cube!

How much do you spend on removing rust before you paint? Why not coat right over the sound rusted metal with Rust-Oleum 769 Damp-Proof Red Primer after simple scraping and wire-brushing to remove rust scale and loose rust . . . saving time, money, and metal! Rust-Oleum's specially-processed fish oil vehicle penetrates through rust to bare metal—while the surface film remains *tough, firm,* and *durable.* You cut costly surface preparations, you receive nearly 30% greater coverage depending upon the condition and porosity of the surface—and you receive the *maximum* in over-the-years protection!

Whatever your color choice may be—Rust-Oleum finish coatings include the color you want. They're manufactured under the same *exclusive* formulation as the Rust-Oleum Primer . . . they assure you of *greater* compatibility, *double* protection, and *lasting* beauty! The best way to see what Rust-Oleum will do for you is to actually try it yourself . . . around your plant or home.

See our complete catalog in Sweets, or send the coupon for a free Rust-Oleum Test Sample . . . one brushful means *more* than a thousand words. Prompt delivery from Industrial Distributor stocks.

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Distinctive as your own fingerprint. Accept no substitute.

STOPS RUST!®

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- ☐ 30-page report on Rust-Oleum penetration
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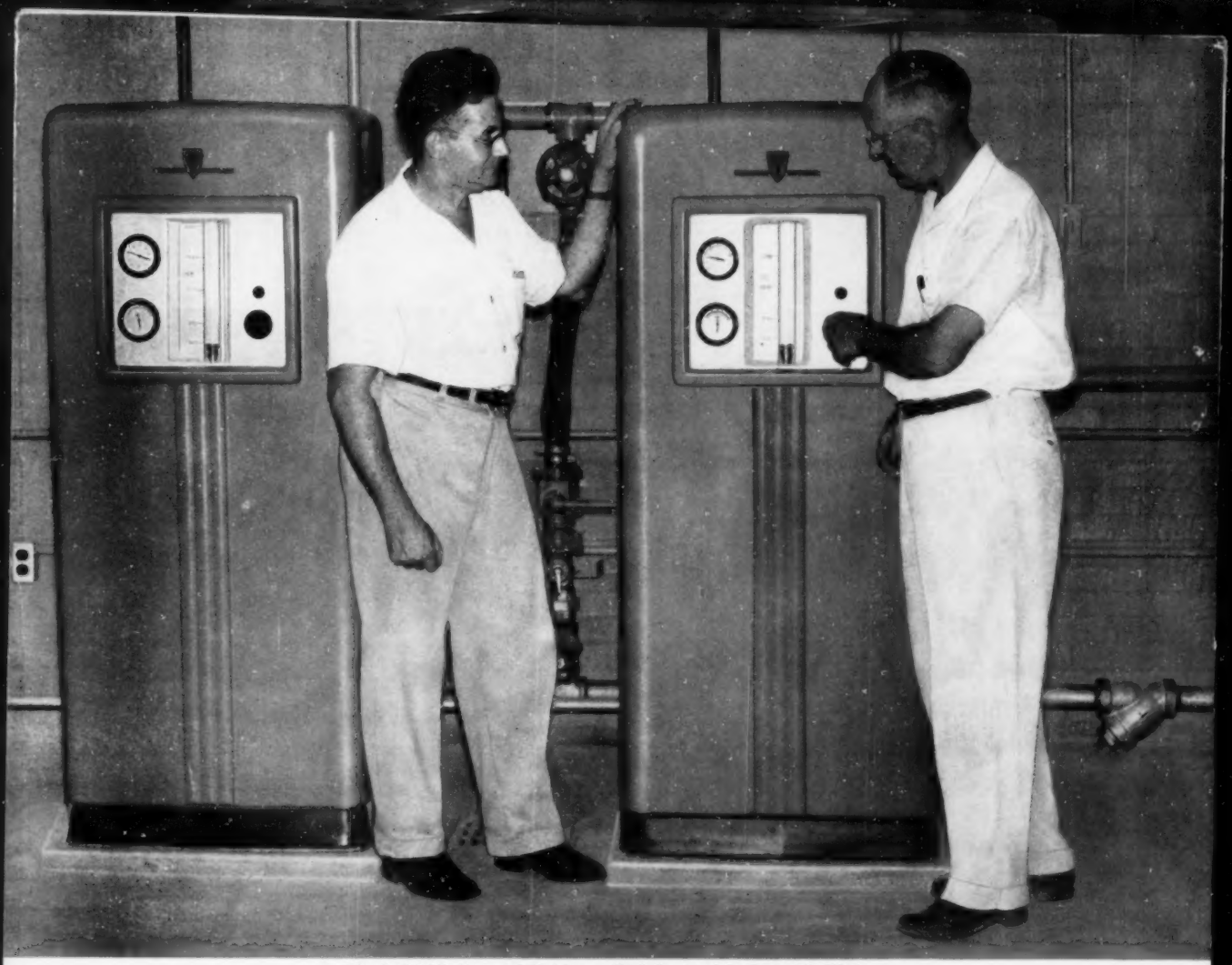

J. Pauli, Chief Engineer and W. Johnson, Chief Chemist of the St. Joseph, (Mo.) Water Company, discuss operation of their W&T V-notch chlorinators. The St. Joseph Water Co. is part of the American Water Works Service Co., Inc. system.

W&T V-notch Chlorinators—
doubly accepted

The St. Joseph Water Co. found breakpoint chlorination the best way to treat Missouri River water. But this increased the range of chlorine requirements in the water treatment. W&T V-notch chlorinators were the answer.

W&T V-notch chlorinators have a chlorine feed range of 20 to 1 with an accuracy of 4%. Based on this acceptance at its St. Joseph plant, the American Water Works Service Co., Inc. has purchased V-notch equipment for use in other plants.

V-notch chlorinators are available to feed from 2½ to 8000 pounds of chlorine per 24 hrs. V-notch equipment also provides permanence and attractiveness through modern reinforced plastics. For comprehensive information about W&T V-notch chlorinators, write for Bulletin S-119.78.

WALLACE & TIERNAN INCORPORATED

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